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SPECTRUM OF COMET *c* 1925 (ORKISZ).

By NICHOLAS T. BOBROVNIKOFF.

At the suggestion of Professor Frost some spectrograms of the comet were taken by the author with the ultra-violet Zeiss camera, aperture 14.5 cm, and 81.4 focal length. Eastman Speedway plates were exclusively used and the time of exposure ranged from 15 minutes to 5 hours. During the period from April 28 to May 29, 1925, twelve measurable plates were obtained, eight of them with a 30°, one with a 15° prism, and two with a combination of both prisms. Although the comet was favorably situated in the sky, being circumpolar during the whole period of observation, its brightness of between 8th and 9th stellar magnitude was too low for spectrographic observation.

Plates were measured on the small Gaertner machine in both directions. As the scale of the spectra is very small, the distance between Hβ (λ4861) and Hθ (λ3798) being 3.1 mm, 6.3 mm, 9.4 mm, respectively for the plates taken with 15°, 30°, and the combination of the two, only a slight degree of accuracy can be expected from the measurements. In fact the probable error of the mean for λ4693 was found to be 2.6 A and for the unit weight for the same band was 7.5 A. For the rest of the bands these figures are undoubtedly too small.

Settings were made on the centers of the knots as in many cases the edges of the knots were not well defined. The measures were reduced by a curve based on the hydrogen Balmer series in the spectrum of the comparison stars (δ Cassiopeiae or Vega). Assuming λ3883 as the wave-length for the best defined cyanogen band in the violet part, the following wave-lengths were derived in the preliminary study.

λ	Identification	Remarks
3883	Cyanogen	Very strong
4004	Carbon Monoxide	Very weak on many plates
4059	Possibly Cyanogen	" " " " "
4179	?	" " " " "
4223	Possibly Cyanogen	" " " " "
4253	Carbon Monoxide	Weak
4359	Possibly Carbon	"
4543	Carbon Monoxide	"
4616	?	Partly overlapping λ4693
4693	Carbon Monoxide	Very strong
5036	Carbon Monoxide	Strong

The wave-length of the band λ5036 was determined by an extrapolation which introduced an additional uncertainty.

The cut (Plate XXIII) represents the spectrum of the comet taken on May 17-18 with four hours exposure, from $22^h\ 25^m$ to $2^h\ 25^m$ C. S. T. It shows a row of knots which are monochromatic images of the comet's head. Each of the three strongest knots is sharper on the side of the longer wave-lengths and shades off toward the violet. The knot λ3883 shows an extension toward the tail about 3′ which gives evidence of the presence of cyanogen not only in the nucleus but also in the tail. An extension into the tail may also be seen at the band λ4693.

Above and below the comet's spectrum was placed the spectrum of the comparison star δ Cassiopeiae, class A5. Ten hydrogen lines and the calcium line K can be seen in it on the original plate. The star was brought on the thread of the guiding telescope after shifting the whole field in RA. Any unavoidable error in setting the star on the thread will affect the absolute wave-lengths by its full amount.

Nearly all the light of the comet was concentrated in the bands λ3883 (Cyanogen) and λ4693 (Carbon Monoxide). Next following in brightness was the carbon band at λ5036, representing thus the ordinary distribution of light in comets. During the whole time of observation a pronounced continuous spectrum was present, even on plates taken with the combination of the two prisms. This reveals a considerable amount of reflected sunlight in the comet as compared with the emission of the comet itself. No striking changes in the comet's spectrum were noted during the time covered by these photographs.

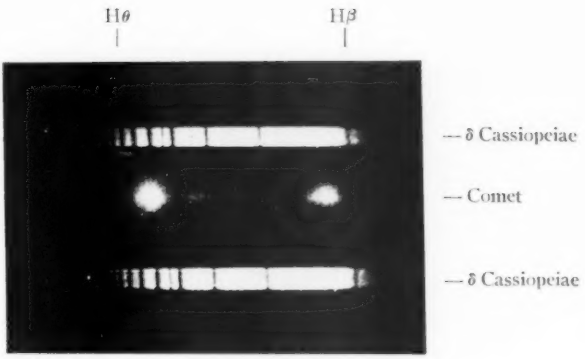
Yerkes Observatory, June, 1925.

NOTE ON THE EXTENT OF THE STELLAR SYSTEM.

By J. G. PORTER.

I find it stated in an article by Professor Shapley, quoted in the *Literary Digest,* that up to about ten years ago estimates of the greatest diameter of the Milky Way varied from a thousand to thirty thousand light years. During all the forty years that I have been giving instruction in astronomy in the University of Cincinnati I have taught my students that the probable diameter of our stellar system is of the order of a million light years. This is easily arrived at in the following simple way. Assuming, according to Dr. Elkin's investigations, that the average distance of first magnitude stars is 36 light years, we get from the light ratio of the different magnitudes an average distance of 360 light years for sixth magnitude stars, 3,600 light years for eleventh magnitude stars, 36,000 light years for sixteenth magnitude stars, and 144,000 light years for eighteenth magnitude stars. Here at once we arrived at a diameter of nearly 300,000 light years for the Galaxy. But many of the stars of each magnitude are much more

PLATE XXIII.



Spectrum of the Comet *c* 1925 (Orkisz).

distant than the average. Hence an estimate of a million light years is not unreasonable.

Another method of getting at the same result is this. Some of the first magnitude stars are certainly more distant than a hundred light years. Imagine these stars removed to 5,000 times their present distance: they would still be visible in our giant telescopes, and would then, of course, not be nearer to us than half a million light years. Granting that light is not appreciably absorbed in passing through space, the only assumption in this reasoning is that stars as bright as those near by also exist in remote regions of space.

I am naturally pleased to learn that these ideas concerning the vast extent of the visible universe, which I have been teaching my students for so many years, and which are based on such obvious data, now seem to be borne out by the more recondite researches of modern astronomy.

Cincinnati Observatory, June 25, 1925.

THE CLEANING OF AN OBJECT GLASS.

By HERBERT A. HOWE.

A few weeks since, it became evident that the 20-inch objective of the Chamberlin Observatory needed to be cleaned. The following directions for cleaning an optical surface were taken from B. K. Johnson's recent book on "Practical Optics," published by Van Nostrand:

"One of the best methods of 'Thoroughly cleaning' an optical surface is to wash it well with soap and hot water, using a perfectly clean linen cloth, then rub it well with a cloth dipped in alcohol, finally rinsing it in distilled water and drying with a piece of 'grease-free' chamois leather. Great care should be taken not to let the hands or finger-tips come in contact with any surface; it will be found advisable to wear a pair of chamois leather gloves when cleaning.

"When mounting optical work into instruments it will be found advantageous to immerse the glass in a 20 per cent solution of nitric acid for about two hours before the cleaning (as mentioned above) is begun, as this prevents to some extent the very objectionable 'filming' that occurs on the optical surfaces when optical work remains in an instrument for some considerable period. In instruments that are finally sealed and made air-tight it is advisable to do all mounting in a perfectly dry atmosphere. All particles of dust should be removed with a small camel-hair brush. Such brushes should be continually washed out in distilled water to prevent grease clinging to the small hairs."

My experience in following them was as follows: The lenses were first washed with soap and water, using a linen cloth, and were then

rinsed in distilled water. Inquiry in several quarters about grease-free chamois brought simply the answer that no one questioned had heard of such chamois. I therefore purchased at different places two pieces of chamois which seemed to me to be of excellent quality and, so far as I could tell, not containing grease in appreciable quantities. When I used these upon the glasses and left them to dry thoroughly, I was disappointed to find a distressing film over the surfaces. Also there were minute bits of chamois scattered over the lenses. The glasses were therefore washed again with a cloth dipped in alcohol and were rinsed in distilled water, being then wiped with an old linen cloth. The result of this operation was very satisfactory. Baade's asteroid, which had been under observation for some time, at once received a decided increase of brightness.

One is reminded of a story told by Professor G. W. Hough: He said laughingly that some one washed his 18½-inch object glass, now at Northwestern University, and he at once discovered a new double star.

Paul Weiss, a prominent optician in Denver, when spoken to about my experiences, denounced the use of chamois very vigorously, saying that it actually rubbed down the surface on which it was used. He said there was nothing better to use than old, soft linen.

COLLOIDS IN THE COSMOS.

By JEROME ALEXANDER.

The development of the ultramicroscope by Zsigmondy and Siedentopf, followed by the work of such men as Perrin and Svedberg, has demonstrated beyond doubt that matter in the colloidal state is in a degree of subdivision or dispersion intermediate between that of ordinary suspensions which settle out, and truly dissolved or molecularly dispersed matter. The ultramicroscope shows that the slight irregular oscillation about a mean position, first observed in 1826 by the botanist Robert Brown, and since known as the Brownian motion, which is exhibited by particles approaching the limit of *microscopic* resolvability (about 250 $\mu\mu$), increases as the dispersed particles become finer, at first slowly and then with great rapidity, until with particles approaching the limit of visibility in the *ultramicroscope* (about 5 $\mu\mu$), it becomes enormous both in speed and amplitude. Thus the particles of a certain platinum hydrosol averaging 25 $\mu\mu$ in diameter, show an amplitude of 2100 $\mu\mu$ in 0.0065 second.

Colloids thus bridge the gap between ordinary visible masses and invisible molecules, and with increasing subdivision their Brownian motion merges into the true kinetic motion of the more profoundly dispersed gases. In fact it may be stated as an axiom that when atoms or

molecules aggregate to make masses, they must of necessity pass through the colloidal zone; and in like manner when masses are dispersed to the molecular or atomic degree, they too must pass through the colloidal zone. Very frequently when particles reach the colloidal zone, they remain there over long periods of time, if not permanently; so that we find colloids in such divergent fields as rubber, metals, soap, textiles, foods, clay, dyeing, brewing, photography, etc. We ourselves, and most of what we eat, use, and wear, are mainly colloids.

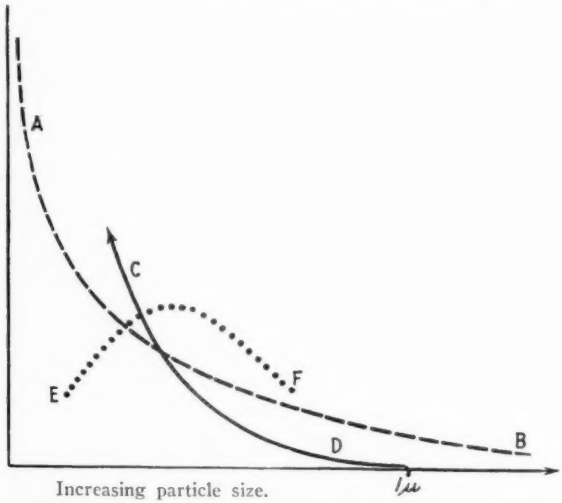
Since matter in the colloidal state is so common on our relatively minute earth, it seems but natural to expect that we should find instances of colloidal dispersion throughout the immensity of space. This has in fact been done, but since the observations were not linked with colloid chemistry, the connection was not noticed. Thus J. Clerk Maxwell figured that with particles having the specific gravity of water, light pressure will bring about a repulsion from the sun when the diameter reaches about 0.0015 mm (1.5 μ). With particles having the specific gravity of minerals and metals, the particles would be still smaller. Then Schwarszchild showed that when the particle size reaches about 0.00007 mm (70$\mu\mu$), the repulsion is overcome. This seems to be dependent on the fact that the intensity of the action of the sun's rays depends on the *surface*, which varies as the *square* of the diameter, while the other forces depend on the *mass*, which varies as the *cube* of the diameter. It is interesting to note that the dimensions found by Maxwell and by Schwarzschild are within the colloidal zone.

More recently Svante Arrhenius in his book "Worlds in the Making" advanced a view of panspermogenesis which depends on the cosmical dispersion of colloidal particles.

A simple kinetic principle underlying the colloidal state is based on the fact that whereas the specific surface (free, outside, or rind surface) varies hyperbolically, if we assume average spherical shape, the Brownian motion which begins with particles of about 1 μ in diameter, increases in a totally different manner. The attached diagram will show that in passing through the colloidal zone, we go from a state where the kinetic motion is quite negligible as compared to specific surface, to a state where the kinetic motion is of transcendent importance, notwithstanding the great increase in specific surface. This leads to a *zone of maximum colloidality*, where colloidal properties are most marked, and this has been observed in quite a number of divergent fields.

The Brownian motion is another factor which must be considered in dealing with the cometary tails, which are composed of matter in colloidal dispersion. The great comet of 1882, which made a transit of the sun, was invisible against the solar disc (a position corresponding to attempted observation of colloidal particles in an ordinary microscope against a luminous background), but became visible again after passing beyond the sun's disc (a position corresponding to successful observation of the same colloidal particles in an ultramicroscope against

a dark background, the eye of the observer being protected against the source of illumination). Furthermore, a few years ago, when it was announced that the earth was about to pass through the tail of a comet, the yellow journals predicted the end of the world, and in Ohio seats were sold for what was to be the final religious service before the dread catastrophe. But no one, not even the watchful astronomers, noticed any appreciable result. Evidently the comet's tail is a macroscopic Faraday-Tyndall effect, a vast celestial camouflage.



AB = free surface per gram; CD = kinetic motion curve;
EF = rise and fall of colloidal characteristics.

FIG. 1.—Relation between kinetic activity and specific surface.

Although the tails of comets generally point away from the sun, they sometimes point toward the sun, as is the case with Baade's comet. It seems to me that the reason for this apparent anomaly is that the particles composing the heliocentric tails are of a size that permits them to be attracted toward the sun, whereas the tails that stream away from the sun are of another critical order of size. The figures of Maxwell and Schwarzschild indicate that the repelled tails are composed of particles in the upper range of colloidal dimensions, and it may well be that particles in the lower range are attracted to the sun. If this be the fact, it will be another instance of the existence of the zone of maximum colloidality before referred to.

It seldom happens that any natural phenomenon is quite as simple as the scientific theory advanced to explain it, and in the case of finely or colloidally dispersed matter in space we must take into account the kinetic motion of the particles, electric charges due to adsorbed ions

or electrons, etc. Owing to the extreme tenuity of the matter in interplanetary and interstellar spaces, it is not possible to term such dispersions *aerosols,* but failing a better term, we might term them *aethersols.*

While the development of tails may be perhaps in part accounted for by the establishment of a tidal effect on approach toward the sun (as was pointed out to me by an astronomer), the directions assumed by the tails, as well as their curious curvatures, are probably to be explained on the basis of the other factors referred to.

The zodiacal light is another phenomenon due to the existence of finely dispersed or colloidal matter about the sun, and in the nebulae, where matter is condensing from perhaps ultra-atomic dispersion into the atoms of our known elements, and then into molecules and groupings of these, we must surely have to reckon with the colloidal state of dispersion and consider the unusual features therein exhibited. Most observers plot their results in plane curves or simple surfaces, using two or three variables. But Nature does not hesitate to allow a very large number of factors to exert their influence simultaneously, and the more of these factors we recognize and analyze, the nearer we approach the truth.

THE RESULTS OF THE MEETING OF THE SECTION OF GEODESY OF THE INTERNATIONAL GEODETIC AND GEOPHYSICAL UNION OF INTEREST TO ASTRONOMERS.

By WILLIAM BOWIE.*

The International Astronomic Union and the International Geodetic and Geophysical Union held meetings at the same time in Rome, in 1922. This, in some ways, was a desirable thing to do, but it prevented the delegates who were supposed to be functioning with the two Unions from attending enough of the sessions of the Sections of the Geodetic and Geophysical Union and of the meetings of the Committees of the Astronomical Union and thus they were very badly handicapped. As astronomy plays an important part in geodetic and other geophysical subjects, it was decided at the Rome meeting that, hereafter, the two Unions should hold their regular conferences in different years. It was planned at Rome that the Geodetic and Geophysical Union should meet in 1924 and that the Astronomical Union should meet in 1925 and that, thereafter, each of the Unions would hold regular meetings at intervals of three years.

The 1924 meeting of the International Geodetic and Geophysical

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Union was held at Madrid, Spain. The formal opening of the meeting took place on October 1, although the Section of Geodesy began its sessions on September 26. The Executive Committee of that Section was in session for the preceding two days, attending to matters which had been referred to it at the meeting of the Section in Rome and in preparing for the meeting of the Section as a whole at Madrid.

King of Spain Presided at Formal Opening of Meeting.

At the meeting of the Union on October 1 the King of Spain presided, called the meeting to order and introduced the speakers. I made careful inquiry among the older delegates present as to whether they knew of any case in the past where a monarch had taken such an active part at an international scientific conference. No one knew of such a case, although in many conferences in the past the monarch of the country where the conference was held had been in the audience during the formal opening. It seems to me that this tribute to science and scientific workers by the King of Spain is worthy of special note and appreciation.

The King invited the officials of the Union and its Sections to the Palace at noon, one of the days of the conference, when he greeted them and conferred with them in an informal manner for nearly half an hour. On one of the evenings of the conference the delegates and the members of their families, together with high officials of Spain and the diplomatic representatives of various countries in Madrid, attended a reception held by the King and Queen in the Palace.

Aside from these attentions by the King and Queen, there were other formal social events which gave the delegates a chance to become personally acquainted with each other and added much to the pleasure and interest of the meeting.

The Agenda of the Section of Geodesy was quite full and contained many items of international interest and importance. These items were segregated into groups and each group was referred to a special committee for consideration and report. There were fifteen special committees appointed at Madrid and it is worthy of mention that each committee did its work faithfully and well, with the result that every item on the Agenda was brought to the consideration of the Section as a whole after having been considered by the Committee.

Items of International Importance Only Should be Considered.

A word in regard to the questions to be considered at these international gatherings may not be out of place. There is a tendency on the part of some to suggest as items for the Agenda matters which have no international significance whatever. They are purely national or even more local. The items that should be considered are those touching on lines of activity that are broader than the confines of any one nation. They involve the necessity of having international agreement or advice as to how the work should be conducted and properly

coördinated, or they may involve the necessity of having the international gathering provide, through its officials, the coöperation of scientific workers and organizations of a number of countries. If the Agenda is limited to this class of items and if much of the work at the conference is done by committees, the meeting is likely to accomplish much and to be successful.

Meeting a Great Success.

It may be said that the meeting of the Section of Geodesy at Madrid was a great success in every way. Representatives from 25 countries were present, involving about 55 persons. The utmost harmony and good will prevailed at all of the sessions and in the committee meetings and it was the desire of every one to arrive at the correct solution of the problems presented, without regard to personal or national feelings.

Accomplishments of Interest to Astronomers.

The results of the meetings which are of special interest to astronomers were:

1. Decision to arrange for and carry out a world wide longitude net in which radio signals would be used for comparing time at the different observatories.

2. It was decided to assist, financially, in the computation, reduction and discussion of the variation of latitude observations, made during the war, while the latitude work was under the jurisdiction of the old International Geodetic Association.

3. The adoption of the Hayford spheroid as the spheroid of reference for deflection stations for the use by countries which have not already adopted a spheroid for maps and charts or which, having adopted one, find a change is desirable.

World Radio Longitude Net.

It will be recalled that the joint committee on world longitude net of the two Unions which met at Rome, two years and a half ago, decided that the question of using radio signals be carefully considered, and it was also concluded that intensive and searching investigations of the instruments used at astronomic observatories in the determination of time should be made. It was the feeling at Rome that the work would be largely one conducted by astronomic observatories, with some assistance by geodetic organizations.

It has been decided by the Section of Geodesy that the results of studies of astronomic instruments and radio signals during the last few years make it appear better to carry on the longitude work with the transits used by geodesists in what might be called field astronomy. Many longitude differences have been determined in the recent past with portable astronomic transits equipped with the transit micrometers, and the results indicate that the average correction to a difference

in longitude to close a loop is of the order of magnitude of 0.01 second of time. This accuracy is all that one may expect of longitude work, owing to atmospheric conditions. Geodesists and others have used automatic recording devices for radio signals, notably in the United States by the U. S. Coast and Geodetic Survey in determining longitudes at points as far away from the U. S. Naval Observatory in Washington as southeastern Alaska. The time signals sent from the U. S. Naval Observatory through the Annapolis station were used in this longitude work.

In the international net there will be a number of countries coöperating, each country using such instruments and methods of recording as the officials might deem best, but it is reasonably certain that most of the countries will use the transit micrometer and will record automatically the radio signals. It is probable that in France the astrolabe à prism will also be used, for the geodesists of that country feel that that instrument will give results equal in accuracy to those obtained by the transit.

It will, of course, be necessary to secure the coöperation of the officials of some of the great radio companies having powerful stations and of governments where the radio stations are under government control.

While the work will be primarily a problem in geodetic astronomy, it is expected that a number of astronomical observatories will coöperate in the undertaking and make time observations from which longitudes of the observatories may be determined.

The radio signals will be used merely as the means of comparing the clocks at two contiguous longitude stations, for it has been learned by experience that the time signals, in general, are not sufficiently accurate for the determination of longitudes. A notable exception, however, is the time service of the Naval Observatory in Washington. The officials of that organization have found that very accurate results are obtained when the transit instrument in the observatory is reversed after each night's observations. There is what is called the "reversing error" in the transit which can be eliminated from the time determinations by combining the observations of two consecutive nights' observations to make one determination of the clock correction. The reversing error of the transit was disclosed by a comparison of the clock corrections obtained from observations with a portable astronomic transit and the large transit of the observatory.

It is believed that it is not necessary to have the same stars used at each of the longitude stations. The errors in the places of time stars are very small and it is believed that larger errors would be introduced into the determination of a difference of longitude by using the same stars, thus having a long interval of time between the observations at one station and another, than by using different groups of stars which could be observed simultaneously.

It is probable that only time stars will be used in the observations

with a close balancing of the sum of the azimuth factors for the stars to the north and to the south of the zenith. By using only the stars close to the zenith the azimuth error is entirely or almost entirely eliminated from the results of the night's observing. This is probably not always the case with observations which depend on having one or more azimuth stars in a set of stars.

It is not definitely known whether clocks or chronometers will be used to carry the time from the observations to the instant at which the radio signals are received. This is a matter which requires special thought and attention, although it is my belief that the gravity pendulums generally used could be employed for carrying the time during the interval in question. The operation would be to determine the period of the gravity pendulum at the beginning or during the occupation of a station and then to use the known period of the pendulum as the unit of time in the longitude work. The view was expressed by the writer to the Committee on Longitudes of the Section of Geodesy that the gravity pendulum might be used to control the interval of a few hours between the time of observations and the receipt of the radio signals. One of the other members of the Committee then announced that a free-swinging pendulum used practically in that work was being employed in one of the astronomic observatories of Great Britain. I have not seen any reference to that matter in any literature.

The importance of the extension of the longitude net around the world, with radio signals used for the comparison of local time pieces, is evident to all. Prior to the introduction of wireless telegraphy the only accurate method of determining longitude was by means of signals sent over cables or land wires. Naturally, the stations have to be placed at the ends of the cables or along the land lines, while with radio telegraphy stations may be placed anywhere to which the instruments may be carried and set up. The network of longitude stations established by means of cables and wires is a very intricate one based on many differences of longitude. Naturally there have developed discrepancies between the longitude nets of different countries. With the use of the radio, the earth may be encircled in the northern hemisphere by a very few longitude differences, possibly between four and six. From these, of course, will radiate many other differences of longitude, during and after the observations made for the world net. It is reasonably certain that if the proper coöperation among the various countries is secured it will be possible to have a network that will be free from large discrepancies.

Test of Stability of Continents by Longitude Net.

Aside from its use as the base for longitude determinations over the whole area of the earth, the longitude net will serve as a means of detecting any movements of land masses tending to separate or to bring together islands and continents. The well exploited Wegener hypothesis has led many to believe that North and South America are drifting

westward from Europe and Africa at a rather rapid rate. There is no direct measurement of any such movement although Wegener used, in a discussion of his hypothesis, some early longitude determinations in Greenland.

The longitude observations made in Greenland and used by Wegener are not of a precise character, as they were made on the moon. In 1922 an exact determination of longitude was made in Greenland by use of radio signals. Should this determination be repeated from time to time, it will be possible to detect any movement of Greenland with the base longitude station used should there be any such movement.

Variation of Latitude.

The Committee on Variation of Latitude at Madrid considered all phases of this important astronomic and geodetic work. It was learned that the International Astronomic Union is making a contribution to Prof. Kimura, who is in charge of the preparation of the star lists for the international latitude work and in making the computations and reductions of the observations. Prof. Kimura needs further financial assistance in that work and the Section of Geodesy will be able to render some help along that line.

The three international stations in the United States, Japan and Italy are now being financed by the governments of those countries. Ukiah station is now under the direction of the Coast and Geodetic Survey. Congress restricted the latitude work to that station but it is hoped that authority may be obtained to operate one or more additional stations. It is believed by many that the Gaithersburg, Maryland, station could be reopened.

The Section of Geodesy has appointed rapporteurs whose duty it is to investigate the status of the various branches of geodetic work and make reports on the several classes to the section when it has a general conference. At Madrid a report by Prof. Kimura on the variation of latitude was presented by Prof. Tanakadate. The report covers the period September, 1922, to March, 1924. In the introduction of the report Prof. Kimura writes:

> "At the general meeting held at Rome, it was decided that on September 6, 1922, the whole work of the International Latitude Service would be handed over to the Geodetic Section of the International Geodetic and Geophysical Union by the old Geodetic Association, after which it was decided a series of observations according to a new program would begin. It is very fortunate to receive the information from Prof. Wanach of Potsdam that the provisional value of x and y up to the above date will be published in due course in the *Astronomische Nachrichten* (Astr. Nach. No. 5314)."

All of the calculation of the apparent declinations of star pairs and all of the reductions of the observations and of the computations of the polar motion, from the results of the three international stations, were carried out by Prof. Kimura, Mr. Kawasaki and five computers.

The report gives the declinations and the proper motions of the stars

in the observing program. Some of the right ascensions, declinations and proper motions were deduced by Prof. Wanach, while the others were by Prof. Kimura and his staff.

The report contains tables and descriptions of methods used in carrying on the computations. Kimura also makes some remarks on the results of his work and shows that the mean latitudes for Mizusawa, Carloforte and Ukiah, for the epoch 1900 and 1901 and for 1923 differ by the following amounts:

Mizusawa	—0".25
Carloforte	— .07
Ukiah	— .07

It will be noted that the latitude of Mizusawa has changed three and a half times as much as either of the other two stations. Kimura offers several explanations of the cause of this difference but he sums up his discussion with the following statement:

> "I have no firm belief now to decide which assumption, local or general, would be nearer to the truth. At all events the problem on the variation of mean latitude should be postponed until close examination of the results obtained up to this time can be made."

One of the big problems connected with the variation of latitude is the computation and reduction and the publication of results of about 10 years of observations made between 1912 and 1922 under the direction of the old International Geodetic Association. The funds of that organization were wiped out by the collapse of the mark in Germany. The surplus of the association had been placed in a bank in that country. It will require several thousand dollars, possibly as much as ten thousand dollars, to have the computations made. This work is under the supervision or jurisdiction of the members of a committee on the variation of latitude of the old association. The members of the committee have collected some funds from geodetic organizations in the neutral countries of Europe and $1500 was obtained from the U. S. Naval Observatory by the sale of the Ross Zenith Tube. The money is used to pay the salaries of computers working at the Potsdam office of the Prussian Geodetic Institute under the direction of Prof. Wanach. As the old Geodetic Association has been merged into the Section of Geodesy, the members of the Section feel that they are obligated to take over the liabilities as well as the assets of the Association. They, therefore, feel that the Section of Geodesy should assist in financing the computations and reductions. However, it is probable that, in order to get the work done in a reasonable time, it will be necessary to secure funds from private individuals and institutions. As one of the international stations is located in the United States, and since the variation of latitude work is so important to astronomers, geophysicists and others in this country, it is probable that some money to assist the computation of the old observations may be secured in this country.

Adoption of Hayford's Spheroid.

For many years there has been much confusion in the geodetic field because of the large number of spheroids used by different countries. In order to remedy this situation, an item was carried in the Agenda of the Section of Geodesy calling for the selection of the best spheroid in existence. This matter was referred to the Executive Committee of the Section and its report was in favor of the Hayford Spheroid of 1909. The reciprocal of the flattening of this spheroid is 297.0 and the equatorial radius 6,378,388 meters.

There was much discussion in two sessions of the Section on the report of the Executive Committee but finally a vote was taken which showed a majority in favor of the Hayford Spheroid.

This spheroid was derived by the late Prof. John F. Hayford while he was in charge of the geodetic work of the Coast and Geodetic Survey.

The spheroid is to be the one generally used over the whole world as the reference spheroid for deflection of the vertical stations, and it is recommended for use in surveys, maps and charts by those countries which have not already adopted a spheroid and those which may wish to change from an unsatisfactory spheroid which they have been using.

While the Hayford spheroid was based upon observations made only in the United States, yet it was considered to be the strongest one in existence, because the theory of isostasy has been applied in making the computations. This is an official recognition of the validity and value of the theory of isostasy.

THE SHADOW BANDS.

By WILLIAM H. PICKERING.

These so-called bands appear to have been very conspicuous at the recent eclipse, and commanded general attention. Their visibility was accentuated by three causes, first that they were cast on a layer of snow forming an excellent screen, second that the sun was low, and third because it was anti-cyclone weather. Their existence is now generally recognized as simply an atmospheric phenomenon, and that there is nothing "mysterious" about them. In fact every star casts these spots upon the ground at night, and it is only because they are so faint that we do not see them. When we watch the brighter stars, however, we see that they twinkle, that is grow alternately brighter and fainter. If we trail them through a telescope on a photographic plate, we also see that they move about, through a range of about a second of arc. The star becomes fainter because its light is refracted away from our eyes, and if its light were intercepted by a screen we should find the surface

mottled with dark areas. Bad seeing is most marked in anti-cyclone weather, when a mixture of air currents of different temperatures is pronounced.

All this was fully explained nearly forty years ago, and the shadow bands so-called were then produced artificially (Harvard Annals, **18**, 95). A brief description of our results may be of interest, however, to any who wish to photograph the bands at future eclipses, or who failed to see them at the recent eclipse. A search light furnished with a large mirror was placed on the roof of the Jefferson Physical Laboratory in Cambridge, three-quarters of a mile from the Harvard Observatory. A sheet was spread on the wall of the Observatory, and when the current was turned on, "a most curious appearance was presented. The screen was seen to be covered with bright and faint patches of light, about an inch in diameter, flashing in a most irregular manner, somewhat like the sunlight shining on distant water that is ruffled by a light breeze. The comparison of one of the eclipse observers of the phenomenon seen at that time to the light reflected from the jet beads of a lady's dress, would be a very apt description of the appearance on the screen. The sparkles of light moved slowly along in the same direction, and apparently with the same velocity, as the wind. As the wind increased in velocity, they lengthened out into flickering lines of light, similar to, but not as regular as, the shadow bands that I saw in 1878. By viewing these lines in a mirror held in the hand, and at the same time turning upon one's heel with the proper speed, one could see that the shadows were not really lines, but dots, moving with considerable velocity. Later in the evening, however, real lines seemed to be formed. They moved horizontally, but were inclined about ten degrees to the horizon, producing the effect of a series of bands moving slowly from the top to the bottom of the screen, with an inclination of ten degrees to the vertical. There was nothing to distinguish them from the bands seen during the eclipse, save their small size and comparatively slow motion. They measured about an inch in breadth, and were about an inch apart. The reflector that we employed was three feet in diameter, and as seen from the Observatory, subtended an angle of 3′. By narrowing the opening to 1′ in breadth, the definition of the bands was much improved. It is with this breadth that the bands begin to be produced by the solar crescent."

"It seemed probable that a similar shadow band effect might be obtained more easily by reflecting sunlight from a distant mirror into a partially darkened room. A mirror measuring 12x24 inches was accordingly set up near the search light the next sunny day, and turned upon a screen placed inside the Observatory. The mottled effect was at once produced, but it was so broken up by cross systems of waves and hot-air currents rising from the balconies and other portions of the building itself, that no true bands could be distinctly made out. One interesting effect was however noted, namely, that the irregular shadows produced by the hot air currents near at hand were much finer

and more sharply marked than those produced by the currents acting at a greater distance from the mirror."

Mandeville, Jamaica, B. W. I., April 1, 1925.

REPORT ON MARS, NO. 30.

By WILLIAM H. PICKERING.

THE WHITE SPOT OF 1922. FORMATION OF THE CANALS.

The most conspicuous and striking single event of this apparition was undoubtedly the formation of the large white spot just to the south of Margaritifer on July 9. Its appearance on that evening when fully developed is shown in Figure 6 of our last Report. At 8:02 E. S. T., a drawing of the region was made, and a round dark area of unusual appearance and some 400 miles in diameter was recorded and sketched near the sunrise terminator, near longitude 15°, latitude —25°. The central meridian of the planet at the time was 331°, ⊙ 187°.8, corresponding to the Martian Date September 49, or 13 days after the equinox. The spot was appreciably darker than its surroundings, being marked 4, while the latter were 5 on our scale of brightness. The average maria are marked 3, and the deserts 7. A straight dark band 100 miles in width, and of the same darkness as the spot, led northerly from it, connecting it with Margaritifer.

The drawing was finished at 8:47, but the spot unfortunately was not again examined until 10:15, since I was busy at the time in proving that the brilliantly blue surface of the Syrtis, which was near the limb, did not give out any polarized light, and therefore was not liquid. It was then at once seen, however, that during the intervening 90 minutes the spot had suffered a great change. It had notably increased in size, and now measured 1100 miles in longitude by 900 in latitude. It had also changed its position, its center having moved fully 300 miles to the north in the meantime. It is certain that this result could not have been due to the spread of vegetation. The simplest and only obvious explanation is that the change of size and position was caused by the thawing of frozen ground to the east, west, and north of the original area, as the morning sun rose higher and higher upon this portion of the planet's surface. It thus appears that ground that is thawed by the sun will produce the effect of dark areas, and also of dark bands or canals.

The interesting feature that had now developed however was a large white spot located slightly to the south of the center of the dark area, and measuring 700 miles in longitude by 550 in latitude. It was therefore considerably larger than the dark spot when the latter was first

seen. Its brightness was 7, or about that of the desert regions, and the canal or band was still visible through its middle. The width of the canal was 70 miles. Its center was located in longitude 23°.5, latitude —13°.4, and it did not coincide with any known canal seen before or since that time. By 11:05 the spot had brightened to 8, and was as bright as the northern polar cap. When at maximum brightness the polar caps are marked 10. The edges of both the spot and the canal were very sharp, but in spite of that fact, and the straightness and uniformity of the canal, there would seem to be but little doubt but that the white spot consisted simply of two clouds.

The next night, July 10, it is recorded at 8:31 that there was no elevation on the sunrise terminator in the place of the spot. The region was clouded, but there certainly was no high cloud there. The whole sunset limb also was heavily clouded, showing that there was much moisture in the planet's atmosphere. By 11:00 the white spot had separated itself from the cloud on the terminator, and was distinctly yellowish and ill defined, indicating that it was now certainly cloud or fog. The canal had disappeared. The spot had elongated itself towards the northwest, was somewhat crescent-shaped and convex towards the west. It measured 1200 miles in this direction, by 500 miles at its maximum width. The southern border had moved northerly 200 miles and its northwestern point 900, crossing the equator to latitude +15°. In longitude its eastern edge was unchanged, but its western edge near its northern extremity had advanced about 550 miles. In 25 hours its center therefore had advanced 550 miles north, and 250 miles west. While the advance of a cloud does not necessarily mean the same thing as the distance traversed by the wind, yet this southeasterly wind of 24 miles per hour is about what we find in direction and speed over the oceans at the same season in the same latitude in our own torrid zone. At this time the southern polar cap, while still large, was melting rapidly, and the northern cap depositing, showing a rapid transfer of moisture from pole to pole.

Although nothing unusual was noted in this region in August, except the striking size and darkness of Lunae, yet on September 14, Martian Date November 3, a round black spot 500 miles in diameter appeared in apparently exactly the place where the white area had been on July 9. Lunae appeared as a similar spot of the same size, while Ganges was very dark and over 300 miles in width. Moreover the whole of Thaumasia was dark, completely hiding Solis from view. This also occurred in 1892. The canal Issedon showed faintly, but the next night both it and Nilokeras were very dark and wide. The whole of this side of the planet seemed to be transformed, but no bright spot analogous to that of July 9 appeared there. This region remained active and changeable throughout our observations in October and November, Ganges being again particularly wide and dark in the latter month. The rapid changes in the appearance of the chief canals of this region clearly implied the presence of water in the form of

moistened soil rather than of vegetation, at this season of the year. Changes somewhat similar, but less marked, were noted in the early Martian September in 1920, but on account of the remoteness of the planet at that time were not well seen. It is of interest to note however that while Ganges frequently appeared broad in 1924, at this same Martian season, yet it was never as conspicuous as in 1922, nor were there any changes in Aurorae and Thaumasia this year at all comparable to those of the previous apparition.

Between June 28 and August 2, ⊙ 181°.5 and 202°.0, corresponding to the Martian late September and early October, Thaumasia increased in length towards the west from longitude 45° to 65° by the disappearance of Aonius. The same phenomenon took place in 1924 during the Martian November. In 1922, from July 5 to the end of the year, Pandora appeared, disappeared, and reappeared in a striking manner, sometimes in the course of twenty-four hours. This must have been due to invisible cloud, or terrestrially speaking haze, since the background was never as bright as the desert regions of the planet.

What is believed to be Amenthes appeared on May 9, ⊙ 154°.1, Martian Date August 46. Nevertheless two hours later on this same date, when on the central meridian, it could not be found although carefully looked for. This illustrates how ephemeral even well marked tropical canals may sometimes be. No Martian clouds were visible in this place at this time. This observation tends to confirm our belief that some of the Martian canals are at times merely shower tracks, which under a hot tropical sun simply dry up. Of course later in the season they may develop vegetation, and become more permanent. At the next presentation, on June 13, ⊙ 173°.0, Martian Date Sept. 24, Amenthes was clearly visible, joining Thoth directly to the Syrtis Minor. This is the first apparition at which it has certainly appeared, although Maggini and others had suspected it in previous years. On the same date Aethiops was seen as a broad dark meridional band, joining Cimmerium to the northern polar cap, and tangent to Elysium at Hephaestus. The next night the northern section had disappeared, although it was then crossing the central meridian, and again no clouds were visible. It was not seen again until the next month, when it was even more conspicuous. The dark border to the southern polar cap, due to the melting snow, appeared for the first time on May 9 corresponding to August 46. The canals bounding Elysium, as we have earlier noticed, nearly disappeared from view during this month, leaving this conspicuous marking almost unrecognizable. At the following presentation in June it appeared as usual.

On June 14, ⊙ 173°.5, Martian Date September 25, clouds crossed the Syrtis when it was within 40° of the central meridian, dividing it in two, as had been the case in 1920 April 20, Martian Date July 41 (Report No. **25**, Figures 19, 33, and 34). This cloud has even been noted on the central meridian itself at the Lowell Observatory, and seems to be a not unusual feature during the late summer and early

autumn of the planet. The northern polar cap very greatly increased in extent in June, between the Martian Dates of September 27 and 29. Its rapidly shifting shape and position from night to night left no doubt in our mind that it was due to cloud. The surface still retained a somewhat greenish tint, as if the cloud only partly covered the grass or foliage beneath it. Much cloud was visible on the deserts bordering the southern maria, as has been frequently noticed on other occasions. It appears as if an upward current of air occurred in these places, carrying the moisture with it and precipitating it as cloud. During late May and June, corresponding to September on Mars, Acidalium went through many very remarkable changes of shape, not apparently due wholly to cloud, but which cannot be described here. Still later, August 2, ⊙ 202°.0, when the apparition was well over, and the planet's diameter reduced to 16″.1, the fine canals crossing the desert in the vicinity of longitude 120° came out (see Figure 11). They were extremely faint and difficult, and this is the first apparition at which they have been visible here. The lakes upon them were large, round, and fuzzy, as they have sometimes been drawn by Lowell. An hour later large areas around them had darkened. Unfortunately weather conditions were such that we obtained only one good view of them before the disk had become too small. It certainly appears regretable that with so much that was of interest occurring at this unusual apparition, and so much more that we must necessarily have missed, that no southern observer furnished with a suitable telescope felt enough interest in Martian phenomena to turn it on the planet, even for the few hours required to obtain valuable results.

Pressure of the Martian Atmosphere.

It has been universally believed heretofore that the atmospheric pressure at the surface of Mars was materially less than that on the surface of the earth. Ratios of 1/10 to 1/4 were commonly assumed. In Report **19**, 7 a numerical result was obtained, in which it was shown that the minimum pressure could not well be less than one-quarter of that found at the earth's surface. No maximum results however have hitherto been secured. The arguments in favor of a low pressure were fourfold. One depended on the surface gravity, which is 0.38 that of the earth. This indicated that an unobstructed gaseous molecule whose radial velocity exceeded 2.7 miles per second could escape from the planet, whereas on the earth it would have to reach a speed of 7 miles. This argument is however by no means conclusive, since the average speed of oxygen and nitrogen molecules at ordinary temperatures is only 0.2 miles, and we do not know that our atmosphere was ever much more dense than it is at present. If it was not, and if it accordingly has not been losing gases to any appreciable extent, then there is no conclusive evidence that Mars could not also retain as dense an atmosphere as ours is at the present time.

The second argument depends on the brightness of the Martian limb

as compared to that of the center of the disk. This assumes that the effect of the planet's atmosphere, like the sun's, or Jupiter's, is wholly absorptive, and therefore must darken the limb. In point of fact the limb of Mars is often brighter than the center, which on that theory would make us see the center of the disk through a greater thickness of atmosphere than we do the limb. It is obvious that the brightness of the limb therefore is due not to lack of absorption, but simply to cloud or haze, so that this argument in favor of a rare atmosphere need not be taken seriously.

The third argument is equally ineffective. It states that the surface detail of the planet, especially near the limb, is so distinct that a dense atmosphere is impossible. A simple mathematical consideration should help us to settle this matter. One can under favorable circumstances just distinguish the maria from the deserts when within 0″.5 of the limb. If we assume that the planet's diameter at this time is 20″, this will correspond to a distance from the center measured on the surface of 71°.8. The ratio of the length of atmosphere traversed by a ray of light coming from this point to the eye, to the length traversed at the center of the disk is as the secant of this angle, or 3.2. The height of our homogeneous atmosphere, that is to say the height our atmosphere would reach if it were of uniform density equal to that at sea level, is 5 miles. Hence if we were outside our atmosphere, looking down on the earth, it would interfere with our vision just as much as the atmosphere does between us and a hill five miles distant at sea level. Consequently, if the Martian atmosphere contained as many molecules over every square foot of surface as does that of the earth, it would interfere with our vision within 0″.5 of the limb just as much as our own atmosphere does in viewing an object 16 miles distant. In the clear dry air of our western plains the interference with vision at such a distance is almost negligible. It is certainly materially less than we find on Mars near the limb. Whence we must conclude either that the Martian atmosphere is less clear than our own under favorable circumstances, or else that it contains more molecules per square foot of surface than that of the earth.

The fourth argument in favor of a rare Martian atmosphere is the simplest of all, and for that reason is probably the one which appeals most directly to the unthinking. They say the earth has a dense atmosphere, the moon has hardly any at all, since Mars in size and mass lies between them, its atmosphere must do the same. In point of fact the reason that the moon has so little atmosphere is on account of its origin as a meteoric ring from the side of the earth, and has nothing whatever to do with its mass.

We now come to a distinct turning point in our views regarding the surface conditions upon the ruddy planet. It has been known for many years to planetary astronomers that the temperature of the Martian surface does not differ very greatly from that of our earth, and that the polar summers indeed are warmer. But while we have no reason

to change our views regarding the temperature of the Martian surface, there are now five very excellent reasons, just developed, why we should change our opinion regarding the pressure of the Martian atmosphere. The first of these has been already referred to in our Report No. **29**, 8. It is there recorded that limb clouds were observed rising over the southern polar cap, and reaching an altitude on two days of 50 and 55 miles. Our own analogous thunder storm clouds have occasionally been known to reach an altitude of 7 miles. If the surface gravity on Mars were increased 2.6 times, so as to equal that of the earth, its atmosphere would be condensed in this same ratio, and we should not expect its clouds to rise higher than 20 miles. But if our clouds were to rise to a height of 20 miles, the pressure upon them would be only 1/15 of what it is at 7 miles, and could only equal it in case there were 15 times as many molecules in our atmosphere as at present. Is it possible that the Martian and terrestrial clouds rise till they reach the same atmospheric pressure? If so, there are then 15 times as many molecules in the Martian atmosphere per square foot of surface as there are in our own, and this implies that the pressure at the surface is 6 times as great as it is on our earth! This figure may of course be modified, increased or lowered, by the molecular weights of the gases concerned, and also by the temperature at the point of condensation of the cloud, but neither of these modifications can change our result very materially. We may therefore take 6 times our atmospheric pressure as a maximum probable figure, and say that the indications are that the pressure is at least likely to be somewhat greater than it is at the surface of the earth.

The second argument that we shall mention in favor of a dense Martian atmosphere is due to Mr. Wright. By photographing the planet by blue, and also by infra-red light, he found that the former gave an image indicating a radius 120 miles greater than the latter. The photographs were taken with a reflector, and all allowance made for chromatic aberration, irradiation, etc., in the path of the rays after passing the focus. He considers the blue image to be that of the planet's atmosphere, and the red that of the planet's surface (*Pub. Astr. Soc. Pacific*, 124, **36**, 246). For reasons presently to be given, I cannot accept the view that the blue image is of the planet's permanent atmosphere, but hold rather that it is of haze supported in the permanent atmosphere. If our own planet were photographed from a distance in the same manner, we might find that the blue image showed haze and thin cirrus cloud, rising in some places to 7 miles above the terrestrial surface, as indicated by the diameter of the red image. Our visual observations of the Martian limb clouds indicate that they rose 8 times higher than our cumulus. Mr. Wright's photographic measures indicate a ratio as compared to our cirrus of 17. He states however that he does not insist on the accuracy of his measures, but perhaps he would be unwilling to reduce the distance he found by one-half. Personally I think his infra-red diameters may be a little too small, since

he states that they agree with the Ephemeris, which is based on the measures of Hartwig, made in 1877.

In 1892 a series of micrometric measurements were made at Arequipa of the polar and equatorial diameters. These measures extended from July 24 to August 18, or during the period when the planet's diameter exceeded 24″. From 14 measures of the polar diameter, after reducing to unit distance, and correcting for refraction and phase, the writer obtained 9″.52 ± 0″.05. From 13 similar measures Professor Douglass obtained 9″.54 ± 0″.07. For the equatorial diameter, from 12 measures by each, we obtained 9″.65 ± 0″.05 and 9″.66 ± 0″.05 respectively. These figures are slightly larger than Hartwig's determination, which is now generally accepted, and which gives 9″.30 for the polar diameter and 9″.42 for the equatorial. We found a polar flattening of 1/76, Hartwig found it 1/78. At the next apparition in 1894, between October 12 and November 21, Dr. Lowell, Professor Douglass, and the writer made at Flagstaff a quite extensive series of measurements, 464 in all, of which over eighty percent were made by Professor Douglass. Dr. Lowell gives the results in his Annals **1**, 75. He makes a correction for irradiation of the disk, which would be doubtless desirable if we were sure of its amount. He considers its value to be 0″.125. In order to compare his results with those of other observers, who make no such correction, we must add this to his published figures, and obtain for the polar diameter 9″.45, and for the equatorial 9″.50. Since both the seeing and instrumental equipment at Arequipa and at Flagstaff were superior to those of all previous observers, it seems likely that Hartwig's value is too small.

In 1892 Mars was in the same portion of its orbit as in 1877 and in 1924. The southern polar cap was melting rapidly, many clouds were seen, and the atmosphere was full of moisture. On the other hand, while the measures in 1894 were in progress the polar cap had entirely disappeared, and the planet's atmosphere should have been dry and clear. This is further indicated by the similarity in the values of the polar and equatorial diameters, giving the theoretical ellipticity of 1/190, which would lead us to believe that the measures referred to the disk itself, and not to the haze in its atmosphere. Taking the difference in the equatorial diameters in the two years, we find that this amounts to 0″.16. The difference between the polar diameters is 0″.08. Their difference divided by 2, expressed lineally is 18 miles, which leads us to believe, if only an equatorial belt of haze existed, that the maximum height to which the haze rose in 1892 in the planet's atmosphere did not exceed this figure. This is 2.5 times that of our cirrus.

A fourth reason for believing in a high density for the Martian atmosphere depends on the recent thermopile observations of the temperature of its surface, which we shall presently briefly describe. These prove that the equatorial temperature of that planet is something like 100° F higher than we should expect it to be, based on the equatorial temperature of our earth. Such a great difference, while

doubtless partly explicable by other causes, implies very distinctly a much denser, not a rarer atmosphere than our own.

Finally we have a fifth, but at present only qualitative method of determining the density of the Martian atmosphere. We speak of our clouds as white, although they are by no means as white as snow. On Mars the clouds are distinctly yellow, as has been noted by many observers. Dr. Lowell even went so far as to describe them as dust clouds. Nevertheless they are of all grades of whitish yellow and yellowish white. On rather rare occasions they appear as white as our own. The polar caps never appear as white as snow near at hand, although whiter than the snow upon distant mountains. For those observers who live within sight of snow peaks, which we do not, it is suggested that we have here a fifth method of determining the density of the Martian atmosphere, by means of a comparison of this sort. This suggestion is particularly recommended to Swiss observers.

For these five reasons, based on observations and investigations favoring a dense atmosphere, and for the four reasons previously given, showing the inadequate support of the view favoring a rare atmosphere on Mars, I believe it is now time for planetary astronomers to change their views with regard to surface conditions on that planet, and adopt the position that not merely its temperature, but also its atmospheric pressure, closely resembles that found on the earth. Heretofore we have doubtless all felt that it was possible that it supported animal as well as vegetable life, and even that intelligent life, if not proved, was not impossible. Now however we may perhaps say that with similar conditions to those found on the earth, and vegetable life assured, animal life is almost certain. Furthermore if it, and if intelligent life exist there, as the straight and narrow canals seem to imply, then the evidence now adduced indicates that it need not be so very unlike ourselves as we have heretofore been led to surmise.

Let us now turn to certain other interesting statements made by Mr. Wright. Regarding the photographs secured with the blue rays, he says "all contrast relating to permanent markings is lost." Doubtless this statement was entirely correct for this apparition, but it is nevertheless by no means always the case, for in 1890 before the color sensitizing process was in general use, or was indeed even well known, we obtained a number of photographs on ordinary plates, showing surface detail which is now better exhibited by means of plates which have been rendered sensitive to color.

In Plate XXIV nine photographs are shown, taken for a study of Martian meteorology (Harvard Annals, **53**, Part 8). On three of these, 6, 7, and 8, surface detail is visible, showing that at times the atmosphere of Mars is quite transparent to the blue rays. The Furca end of Sabaeus is central in No. 6, Sabaeus and the Syrtis are shown in No. 7, while the Syrtis itself is central in No. 8. The instrument used was a 13-inch Clark refractor, and the first photograph was taken at Cambridge, Mass. The remaining eight were taken from Mt. Wilson,

California, where the Solar Observatory is now located. The image was enlarged at the focus of the telescope in the first case to 5″ to the millimeter, in the others to 2″, corresponding to a focal length of 338 feet. In these latter views the exposure ranged from 60 to 90 seconds. The image was again enlarged before printing. The prints in the Annals are poor, and are enlarged too much. The negatives were reprinted on a smaller scale, the same as is here used, in *The Technical World Magazine,* 1906, 460, and in my little book on Mars. A detailed description of the photographs is given in Table I. The third and fourth columns give the longitude and latitude of the center of the disk, and the last two the solar longitude and corresponding Martian Date.

EARLY PHOTOGRAPHS OF MARS.

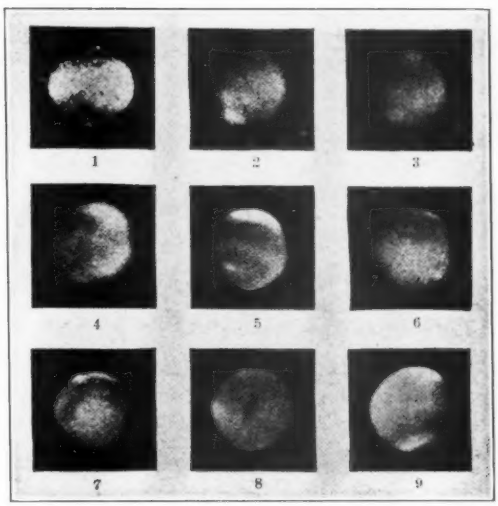
TABLE I.

No.	Date	Long.	Lat.	Diam.	☉	M. D.
		°	°	″	°	
1	'88 Apr. 26	206	+22	15.3	121.0	July 37
2	'90 Apr. 9	133	5	12.8	134.4	Aug. 8
3	" " 10	120	"	"	134.9	" 9
4	" " 15	62	"	13.6	137.4	" 14
5	" May 1	245	6	16.1	145.3	" 29
6	" " 26	357	9	18.9	158.4	" 53
7	" " 31	332	10	19.3	161.0	Sept. 2
8	" June 1	301	11	"	161.6	" 3
9	" " 30	3	14	17.4	177.6	" 32

In these photographs it was shown that clouds may often be photographed on the planet that are wholly invisible to the eye. In 1888, out of 26 plates examined, 54 percent show traces of clouds near the center of the disk, and 15 percent show an equatorial band of cloud or haze. No. 1 in the Plate illustrates the latter, and shows that no surface detail could be photographed through it on such a plate. Nevertheless no such effect is ever seen by the eye. It is clear that this appearance is due to equatorial haze, and not to the Martian atmosphere itself. By the word "haze" as here used is meant an opacity so slight that on the earth we could distinguish through it a hill or mountain 10 to 15 miles distant, but yet could not photograph it on an ordinary dry plate. Probably some haze of this sort covering the whole planet occurred this past year, as is indicated by Mr. Wright's photographs taken by blue light. Indeed we often remarked ourselves that Mars seemed especially lacking in contrast at this apparition. No. 9 in the Plate is taken with practically the same central longitude as No. 6, yet like Mr. Wright's photographs shows no surface detail. The difference between them must be attributed simply to the fact that in No. 9 the Martian atmosphere was full of haze, while in No. 6 it was clear. Undoubtedly in order to study the Martian clouds to the best advantage we must photograph them by blue light, and compare our results with drawings or with photographs upon orthochromatic plates.

In 1890, out of 46 plates, 63 percent showed traces of cloud or haze

PLATE XXIV.



PHOTOGRAPHS OF MARS

taken at Harvard Observatory and the Harvard Station on Mount Wilson in Southern California in 1888 and 1890.

near the center of the disk, while 52 percent gave evidences of an equatorial band of cloud. This latter is illustrated in No. 5. In No. 2 and 3, taken on successive nights, we note a dispersal of cloud in the northern hemisphere, and the formation of a cloud cap at the southern pole. The increase in this cap five days later, shown in No. 4, is marked. In No. 5, taken two weeks later still, we have what appears from its sharpness and brilliancy to be a deposition there of snow. Since it is near the end of the southern winter, this is what we might naturally expect. The slow and gradual diminution of the snow caps was first noted by Herschel, but this we believe is the first record of their rapid formation. The small bright spot in the northern hemisphere in this figure is located over Elysium, where cloud masses have frequently been noted visually. In No. 7 is given the first record that we have of a limb cloud such as is described in our last report. It must have been very conspicuous visually. Indeed something was vaguely seen there the next night in Cambridge, although the seeing was recorded as very bad. The Martian Date at which it appeared is just 30 days earlier than that of the first projection that we saw in 1922. In our last Report we stated that we were not aware that Limb Projections had been observed elsewhere than in Arequipa and Jamaica, or between 1892 and 1922. We now find that they were also recorded at the observatories of M. Jarry-Desloges at the apparitions of 1911 and 1914, and that one was even seen as late as 1916 (Observations des Surfaces Planétaires **3**, 143, **4**, 90, and **5**, 83). A limb projection was also seen and photographed at the Lowell Observatory in 1911, under the title "Autumnal Frost on Mars" (Bulletin **71**).

The southern pole was now turning away from us, concealing the snow, but clouds were forming around the northern one as the autumnal equinox was approached. In No. 9 we have a photograph of one of those striking northern cloud formations which were described in Report **23**, 8, under the name of snow storms. The photograph makes it appear as if the storm had reached its maximum intensity in the afternoon. Most of those observed in 1920 appeared to have occurred at night. The last one detected in that year was on the Martian Date of September 20. What was apparently the first one in 1890 occurred twelve days later in the Martian year.

A more complete description of these observations and early photographs will be found in the volume of the Harvard Annals above mentioned, but we understand the planet so much better now than we did when that description was written, that a brief reference to them here in connection with the more recent photographs taken at the Lick Observatory does not seem out of place. The reason why Mr. Wright obtained no evidence of surface detail with blue light this year, we believe therefore is not due to any peculiar constitution of the Martian atmosphere, differing from our own, but simply that during his observations, owing to the very rapid melting of the southern polar cap,

the atmosphere was full of thin haze, penetrable only to rays of long wave length.

The Temperature of Mars.

Besides Mr. Wright's paper, we find in the same publication two others, one by Messrs. Pettit and Nicholson, the other by Messrs. Coblentz and Lampland, both dealing with the temperature of Mars. The former used the 100-inch mirror in California, and the latter the 40-inch at the Lowell Observatory. Both used thermocouples, and their results were in general confirmatory. The former found for the center of the disk a temperature of 45° F, and the latter a result ranging between 45° and 65°. There is nothing surprising in these figures, indeed in Report **23**, 12, it was suggested, based on observations of vegetation and snowfall, that the mean temperature of the equatorial regions of the planet, day and night, might be not far from 40°.

But what is curious and unexpected is that the former found for the polar regions, where the snow was still melting, a temperature of —90°, and the latter state that these regions "emit practically no planetary radiation"! Near the limb the temperature according to the former is only 9°, and at the limb itself "much lower". Further the temperatures were distributed symmetrically on either side of the central meridian, with "no displacement of the point of maximum radiation," such as might be caused by rotation, as on the earth. The latter found "the morning side of the planet at a lower temperature than the afternoon side." How different all this is from what is found on the moon. There when the moon is full "the heat in the circumferential zone differs from that at the center by only about 20 percent" (The distribution of the moon's heat, 36, by F. W. Very). On the earth at sunrise and sunset, as compared with noon, it differs much less than that.

How shall we explain these results? We cannot go back of the observations, which except for the last one are mutually confirmatory, but it is possible that they have not been correctly interpreted. If the diverse observations of Mr. Wright and the writer, both leading to the same result, that Mars has a very dense atmosphere, are correct, and if according to them it has several times as many molecules per square foot of surface as that of the earth, then it is clear that there can be no such range of temperature between the limb and the center of the disk as is suggested in these two papers.

Earlier observations we know showed that the planet Jupiter, like the Martian polar caps, gave out practically no planetary radiation. There can hardly be any doubt in the mind of any living astronomer however that the interior of Jupiter is excessively hot. Were it not for its absorbing atmosphere it might perhaps shine like a sun. Assuming the rotation of the markings in the middle latitudes to give the true time of rotation of the planet, then the equatorial markings are swept along by the wind blowing 250 miles per hour. New spots covering areas nearly as large as the earth sometimes suddenly appear, and then

again as suddenly vanish. The red spot has of late years changed its rate of revolution by several seconds. The energy consumed in producing these changes cannot come from the sun at such a distance, and necessarily implies an enormous evolution of internal heat. How dense and how deep an atmosphere is required to conceal the true temperature of this tremendous planet?

It can readily be shown mathematically that if the earth had no polar caps, no oceans, and no atmosphere, that at our summer solstice the hottest place on its surface would be the north pole. Owing to these circumstances however, the temperature of the pole is actually lowered to about 50° F below that found on the equator. Now Mars has an atmosphere producing a pressure presumably like our own, very small polar caps at the solstices, and no oceans. It is not likely therefore that the polar temperature is anything like 50° below that at the equator. Moreover the polar regions have sometimes been recorded as a bright vivid green, like young grass in the spring. At the summer solstice in 1924 the polar cap was less than 500 miles in diameter, and was still melting. A temperature of —90° F, or 135° below that at the equator, therefore appears preposterous. But if the Martian atmosphere is of such a density, or of such a nature, as to erroneously indicate such a low temperature at the limb and at the poles, it must also have some effect at the center of the disk. If our reasoning is correct therefore, the results given in the two papers referred to must be considered merely as giving minimum results, and it is possible that, chiefly from the lack of oceans, but also owing to the dense atmosphere, both the Martian equatorial and polar temperatures may be in reality appreciably higher than our own.

It has generally been assumed heretofore that the maria in the southern hemisphere were at a lower level than the deserts in the northern. According to Coblentz and Lampland the difference in their temperature is 15° C or 27° F, the deserts being the colder. On the earth a diminution of 1° F corresponds to an increase of 300 feet in elevation. This would imply that the deserts were on the average 8100 feet higher than the maria. If the densities of the two atmospheres are alike, this same figure might also apply to Mars. This difference in altitude we could hardly detect telescopically by terminator observations, so very likely this difference in elevation is approximately correct. We often see clouds lying on the deserts at the border of the maria, and perhaps we may say that we now know, what we formerly only suspected, that these clouds are lying on the southern slopes of the grand plateau bounding the maria on the north.

It is noticeable that certain portions of the southern maria, particularly between Elysium and the Syrtis, extend considerably farther north at certain times than at others, while other portions, such as that part of Sabaeus south of Edom, appear quite unchangeable. Vegetation will apparently grow only under favorable seasonal conditions in the former region, while it will grow at all times in the latter. The

former is therefore presumably more elevated than Sabaeus, or expressed otherwise, the slope from the maria to the deserts north of Sabaeus is more precipitous. We are led to this same conclusion from the fact that this is also the place where the boundary clouds are the most frequent and noticeable upon the planet. Based on this same theory the region south of Sabaeus is also elevated. Sabaeus accordingly lies in a long narrow valley, and possibly the same may be said of Pandora and Cerberus.

If the temperature of the equatorial desert regions fails to rise above the freezing point, or only slightly exceeds it, and drops below freezing every night, we can readily understand why vegetation there is scarce, or non-existent. With a low temperature and high atmospheric pressure, it is now clear how the chief northern canals can exist throughout the day without much evaporation. They are then simply areas of moistened ground, the moisture being deposited from fog at night along the tracks of winds proceeding from the polar caps, and drawn in the course laid down by Ferrel's theory of the winds towards the most marked depressions in the surface of the planet. These new views remove what has always appeared to me to be the main objection to this explanation of the chief canals. The finer straight canals can hardly be due to air currents, and it would seem that they must be laid down on the surface of the soil itself. While these recent observations of the temperature of Mars may not give us all the information that we had formerly hoped for, as to the actual temperature found on the surface of the planet, yet they undoubtedly form a most important contribution to our knowledge, and we must congratulate the four observers on the great skill and success with which they have carried out these exceedingly delicate measurements.

These new ideas with regard to the Martian atmosphere lead us to look on the planet as a much closer facsimile of our own than we had previously believed. While the surface gravity is less than ours, the atmospheric temperature and pressure appear to be much the same. Mars therefore differs mainly from the earth in that our oceans are replaced by elevated deserts. The maria must be very like our continents, and the planet's meteorology like our own, except for the fact that it is that of a desert planet instead of an oceanic one.

Private Observatory, Mandeville, Jamaica, B. W. I.
December 20, 1924.

Note on Dr. Van Biesbroeck's Observation.

In Popular Astronomy for December, 1924, Dr. Van Biesbroeck records an observation of a limb cloud, seen on the evening of October 27, at $14^h\ 15^m$ G. M. T. The same cloud was recorded here in a drawing made by Mr. Hamilton on the same evening between $13^h\ 15^m$ and $13^h\ 37^m$, our eastern longitude accounting for the earlier observation. In this drawing the cloud is about half the length of the one drawn in

POPULAR ASTRONOMY, and is located over Mare Chronium some 800 miles farther to the south. The seeing was recorded as 7 to 8 on our Standard Scale of 12. I made a drawing between $14^h\ 50^m$ and $15^h\ 10^m$ closely resembling Dr. Van Biesbroeck's, but did not notice the cloud. Mr. Hamilton did not call my attention to it, possibly because we had both recorded a similar, but somewhat more conspicuous one the previous week. That one lasted through five successive nights, and will be referred to in a later Report. This cloud was not seen on October 28, or on the following nights, although the seeing was excellent.

Dr. Van Biesbroeck records that he saw no canals or lakes on that evening in spite of the excellent seeing. The main reason for this is that on that evening, at that time, there were no canals or lakes visible. Conspicuous canals are not always to be seen on Mars, and it is doubtful if the finer ones can ever be detected as far north as the Yerkes Observatory. All Martian observers go south, where the seeing is better, in order to study the planet. However, if he had looked at Mars a week later, he might have seen some of the more conspicuous canals surrounding Solis Lacus. In spite of the general impression, the time to see the canals of Mars, as was pointed out many years ago by Lowell, is not when the planet is nearest us, but when its northern hemisphere is turned towards us at the more remote apparitions, which occur in the spring of our year.

Private Observatory, Mandeville, Jamaica, B. W. I.
December 20, 1924.

UPON THE THRESHOLD.

Earth and her close-chained children speed through Space
A grander vista greets the human race;
The keen-eyed shepherds who once kenned the skies
Are scientists today with keener eyes,
That watch upon the Threshold whilst they gaze,
Discerningly, at years of solar rays.

Upon the Threshold! Not across, just there,
A single step beyond Earth's sea of air;
Man views the dawn of knowledge, fair and bright,
Behind him lies, eternally, the night,
A step from dark to light—long, slow and far—
From Solar System unto measured star.

Man watches on the Threshold—forward bound—
And looks not backward nor upon the ground.

—CHARLES NEVERS HOLMES.

18 Pearl St., Reading, Mass.

A NEW OPTICAL PROJECTION PLANETARIUM FOR VISUALIZING THE MOTIONS OF THE CELESTIAL BODIES, AS SEEN BY THE NAKED EYE, FROM THE EARTH.

By DAVID TODD.*

When in the seventeenth century the obstacles to general acceptance of the Copernican, or sun-centered scheme of the Solar system were apparently insuperable, the great mechanical genii of that age, Christian Huygens (1629-95) in Holland, and Olaf Roemer (1644-1710) in Denmark were the most prominent advocates who came to the rescue by their ingenious invention and actual construction in brass and iron of the so-called *Planetarium,* a machine for showing clearly the relative motions of the planetary bodies in conformity with the Copernican doctrine.

Some of these planetaria—laughably crude mechanical affairs they seem today—exhibited these orbital motions in circles, others in ellipses. Later types were known as *tellurians* and *lunarians,* to show the earth's motion around the sun, and the moon's motion around the earth.

The succession of day and night and their varying length with the seasons, the different types of eclipses of sun and moon (mechanically embodied in another type of machine known as the *eclipsareon*), and even the intricate motion of the moon's orbital nodes and perigee, were shown with a highly meritorious degree of success. Still another *satellitarian,* so called, exhibited the beautiful movement of the four Medicean Moons or satellites around the giant planet Jupiter.

In England Graham built for Charles Boyle, the fourth Earl of Orrery (1676-1731), one of these complicated astronomical machines which was named for him, thus originating the word "Orrery," as now generally applied to all such types of mechanism. Many were the complicated problems successfully attacked and solved in its construction, requiring the expenditure of much time, patience and money.

Just as in all other departments of applied science where advance has been dependent on previous progress in metallurgy and the mechanical arts—astronomy and telescopes, biology and microscopes, navigation and nautical instruments offer excellent illustrations,—so in the slow evolution of the grand idea of visualizing and incorporating into a concrete mechanism all the appropriate phenomena of the starry

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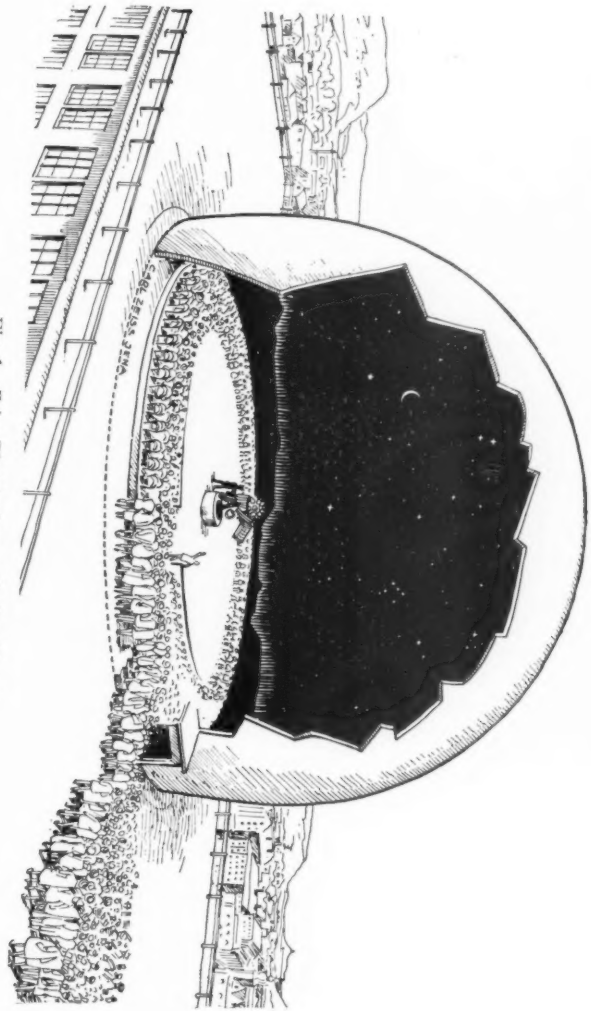

Fig. 1. Zeiss Planetarium, a Stellar Theater.
(Mounted on Roof of a Factory Building of the Zeiss Works.)

heavens, it has been wholly impossible, until the dawn of the twentieth century, to design and construct an apparatus which should, by its successful working, competently and accurately illustrate to considerable groups of human beings all that unending succession of intriguing phenomena of the day and night time sky, in such a measure as to leave little if anything farther to be desired.

In America the most famous orrery ever built is that constructed by America's first practical astronomer David Rittenhouse (1732-96), and now one of the most highly prized astronomical trophies of Princeton University, and nobody who will take the trouble to inspect this intricate mechanism can fail to be impressed with the genius of a builder who could not only design but with his own hands construct so marvellous a piece of celestial enginery at so early a period, when tools were few and the art of deft fashioning in brass and iron was only in early infancy.

But it has been reserved for Dr. Bauersfeld of the Carl Zeiss Optical Works in Jena to make the first complete solution of this problem, so significant in the ultimate popularizing of the noblest of the sciences, thus enabling for the first time in history the "man on the street" to comprehend quite as fully as the learned professor, the seemingly intricate, though actually simple, workings of the celestial mechanism. And if he but comprehends, then "to understand is to become interested."

The very best orrery hitherto constructed can furnish only a crude and unsatisfactory imitation of the planetary movements, since radial wires and solid spheres and globes cannot possibly be made to simulate such immense differences of size and distance as exist in the solar system alone. Neither can the various bodies be made to describe their free and unimpeded orbits so long as the models representing them are supported at the ends of radial rods.

Moreover, a person following the motions of an orrery is in the position of a living being outside the solar system, to say nothing of the fact that the existence of the fixed stars is necessarily ignored in these strictly mechanical orreries. True, a purely mechanical orrery is conceivable, and one has indeed been set up in the Deutsche Museum at Munich. In this the spectators are stationed near the centre of a dome-shaped rotunda, along and upon the surface of which the earth and moon are made to travel in their orbits by electromechanical means, while a large electric arc lamp at the centre represents the stationary sun of the Copernican system. While this forces the spectator to occupy the position of a solar being, as it were, many celestial phenomena, such as changes of the seasons, sequence of day and night, and phases of the moon can be explained more or less adequately.

Shortly before the war the Deutsche Museum at Munich commissioned the Zeiss Works at Jena to design a large Planetarium which would enable the motions of the heavenly bodies to be watched as seen from the earth. The original idea was to accommodate the spectators

at the centre of a large rotunda, the hemispherical dome of which was to represent the starry heavens with the aid of small glowlamps; while sun, moon and planets were to be represented by luminous disks attached to radial rods and moved over the surface of the dome along their correctly indicated orbits.

The very first attacks upon this problem disclosed the hopelessness of any attempt to solve it by purely mechanical means, and soon after the war the project was taken up from a fundamentally different aspect. The hemispherical dome, which in the original scheme must necessarily rotate about an oblique axis conforming to the polar altitude, was now arranged as a fixture and prepared as a white projection screen. Also all fixed stars, the sun, moon, planets, and even the Milky Way, were to be projected thereon (down to the horizon but no further, in strict accord with their apparent motions) by means of a specially computed and constructed system of optical projection lanterns.

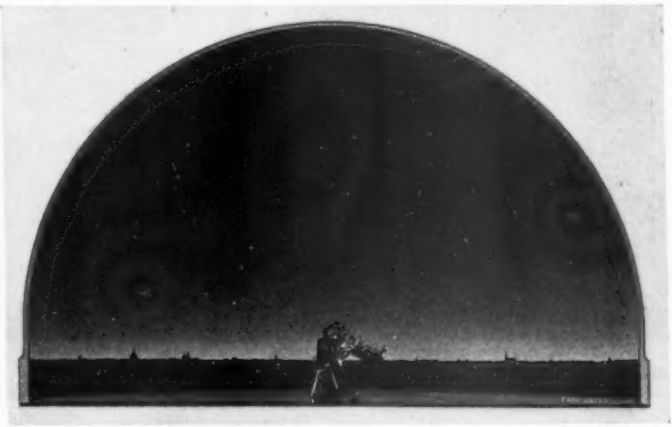

Fig. 2. Stars and Planets as Projected on Interior of Dome by Zeiss Apparatus.

For popular demonstrations, where large numbers of visitors must be accommodated, the size of the Jena Planetarium of 83 ft., affording seating accommodations for approximately 700 spectators, may be increased up to 130 ft. inner diameter. This increase of the dome also greatly heightens the illusion of gazing into the infinite heavens. Larger cupolas are not recommended, as the acoustic qualities diminish proportionally, making it hard to clearly understand the lecturer.

The cost of maintenance and operation is relatively small, as only a lecturer and one operator are required to demonstrate the apparatus, and the current consumption of the fractional horsepower electric

motors and the electric light is almost negligible.

The projection of the 4500 fixed stars of the first to the sixth magnitude of brightness, which are shown on the dome, proved a comparatively simple matter. In order to obtain a continuous projection or reproduction of the system of fixed stars upon the spherical surface of the dome, thirty-one separate projectors were mounted upon a spherical shell of gunmetal, with a nitrogen lamp of 200 c. p. at its centre; and they were so divided up that the thirty-one lantern slides derived from large-scale star maps would form a continuous picture of the stellar sky on the inside of the dome. The required spherical shell may be described as an icosahedron, having each of its twelve corners cut off by planes in such manner that the resulting twenty hexagons and twelve pentagons have identically similar circumscribed circles.

Fig. 3. Carl Zeiss Projector in High Position of Zodiac.

Fig. 4. Carl Zeiss Projector in Low Position of Zodiac.

Zeiss Stellar and Planetary Projection Apparatus.

The stars are represented by disks of varying diameters according to their magnitude, without prejudice to the accustomed starlike appearance. The Milky Way is projected by means of a number of small lantern attachments giving slightly nebulous images, and a few small projection attachments have been added to indicate the names of the constellations.

The fixed star projector is mounted upon an axis corresponding to the earth's polar axis, so that the projected celestial dome may follow the diurnal motion.

Separate projection heads have been devised for projecting sun, moon and planets. All attempts to reproduce, even in rough approximation, the epicyclic orbits of the planets by direct mechanical means

have proven impracticable; so that recourse was had to the simple Copernican aspect, and a mechanism was devised to show the orbits correctly by indirect means.

The arrangement adopted is readily intelligible if we regard the fixed stars as stationary upon a large sphere with a central stationary sun, about which the earth and the other planets move in elliptical orbits. Then it follows that a planet's position, as seen from the earth, is always at that point where a line joining the earth and the planet meet the celestial sphere.

To imitate the relative motions of the earth and a planet, the point which represents the earth is supposed to be joined to the position of the planet by a telescoping tube combination, capable of adapting itself to changing distances. Also small projection apparatus is attached to the end of an extensible tube (or the parallel trellis-linkage which is actually employed.)

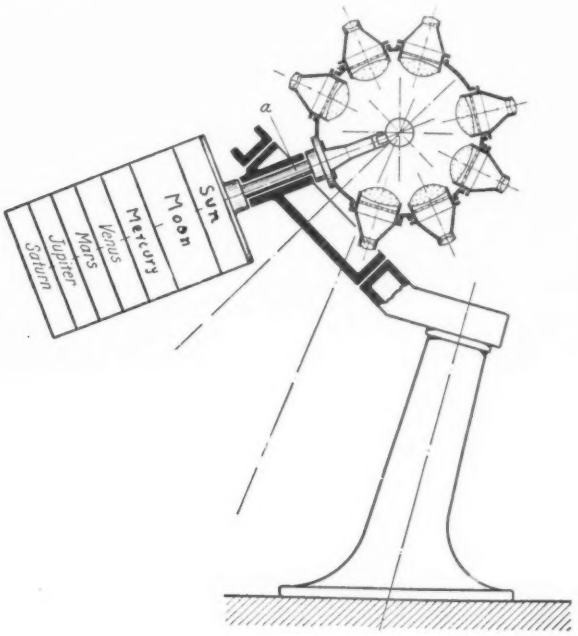

Fig. 5. Diagramatic View of the Projector. The optic arrangement of the planets one above the other may clearly be discerned.

In order that the mechanical projectors for the planets may not interfere with each other, it became necessary to arrange them one above

another, in consequence of which the orbit of the earth had to be repeated in conjunction with each of the planets Mercury, Venus, Mars, Jupiter and Saturn (Uranus and Neptune being omitted from the scheme, since they are purely telescopic objects).

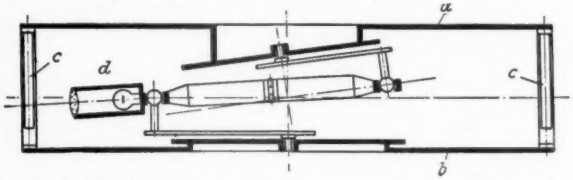

Fig. 6. Mechanical and Optical Arrangement of the Planet Mercury.

Fig. 6 illustrates the arrangement in the case of the planet Mercury. The five planet motions are mounted about an axis at right angles to the earth's ecliptic, and which is capable of being permanently set with respect to this celestial axis. The axis of the ecliptic is set at a permanent angle of 23.5 degrees with respect to the earth's polar axis. No allowance is of course made for the very slight secular changes due to the slow reduction of the obliquity of the ecliptic and the periodic fluctuation known as nutation. The effect of precession, on the other hand, was taken into account by applying an additional rotation about the axis of the ecliptic (*a*, Fig. 5) to the entire system of projectors for the fixed stars, together with the mechanism for the motions of sun, moon and planets.

The motion mechanism for the sun projector (which is situated immediately below the axis of the ecliptic) proved a simple matter, as the sun's axis is readily represented by a fixed central pin, so that it became necessary to reproduce only the earth's motion.

In the case of the moon, a fixed central pin takes the place of the earth's axis, but the representation of the orbit necessitated various complications. In the first place the lunar orbit, unlike the planetary orbits, experiences rather rapid changes. Its plane is inclined at an angle of a little more than 5 degrees. This was taken into account by setting the central pin for the lunar orbit at a corresponding angle. Small changes in the inclination of the lunar orbit, being periodic, have been ignored. Changes in the direction of the line of nodes (or intersection of the lunar orbit with the ecliptic) in view of the fact that it completes its cycle in 18.6 years, were taken into account by applying an additional rotation to the oblique central pin of the lunar orbit. The further troublesome factor that its major axis turns in the course of every year through an angle of 40 degrees, would, if taken into account, have led to inordinate mechanical complication and to great difficulties in designing the gear mechanism. For this reason the lunar orbit is reproduced by a circular motion, occasioning at the most a positional error of about 6 degrees in consequence of the small eccentricity (0.055) of the lunar orbit.

The phases of the moon are imitated by mounting (immediately behind the circular diaphragm which furnishes the projected image of the full moon) a small revolving stop of the form shown in Fig. 7. This provides an adequate means of reproducing the phases of the moon within a single period, i. e., from one full moon to the next; but its continued rotation would furnish instead of the phases of the next period their respective mirror images. In order to maintain a continuous motion and to obviate the necessity of an intermittent return to the initial position, the phase-projecting attachment has two alternately operating projection-heads.

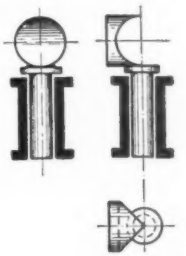

Fig. 7. Small revolving stop immediately behind the circular diaphragm which furnishes the projected image of the full moon, imitates the phases of the moon.

The phases of the planets are not reproduced since they are not naked-eye phenomena.

The whole apparatus is driven by an electric motor mounted at the side of the cast iron base. By means of a change-speed gear an astral day can be reduced to either 4½ minutes, 2 minutes or 50 seconds. The motions of sun, moon and planets, as projected against the celestial globe, are naturally slow; but by disengaging the motion of the polar axis, their motions may be shown at a rapid rate upon the stationary fixed-star sky. This motion is furnished by an independent electric motor which is directly geared to the main axis of the planetary mechanism. It can be run at three speeds, showing the annual changes in 4½ minutes, 50 seconds or 7 seconds. The latter speed is mainly provided in order to establish the celestial constellation for any particularised date, past or future, and the motion may also be reversed for this purpose.

When the annual motion is operating, the looplike orbits of the planets stand out clearly. The fixed stars do not appear entirely immobile during this operation, since they experience a very slow rotation about the pole of the ecliptic in consequence of the superposed precessional motion.

The whole of the motions are interlocked by gear wheels and accuracy of the motions of the sun, moon and planets over long periods is predetermined by a selection of proper gear ratios.

The case of Mercury will show how the required train of gears was arrived at. The driving axis common to all planet motions was given ten revolutions during a sidereal year, so that the transmission ratio of the solar apparatus was 1 : 10. For Mercury it was according 0.415 209 106, which, with the aid of continued fractions, was found to be furnished by the train

$$\frac{3^3 \times 11 \times 43}{2 \times 7 \times 13^3}$$

with a degree of approximation of 10^{-7}. This error would occasion, in the case of Mercury, a positional error of only 1 degree in 5000 years.

To reduce friction to a minimum the gear-system runs in ball bearings.

Fig. 8. Method of Construction of Reinforced Concrete Dome for Zeiss Projection Machine.

By operating jointly the diurnal with the annual driving motions at such a rate that the sun remains steadily in its midday position, the spectator can be made to see the celestial motions as they would appear to an inhabitant of the earth if it always turned one and the same half to the sun. The orbits of the inner planets are then seen as flat projected ellipses, while the outer planets are seen to traverse the entire

zodiac; and the sun executes a periodic up-and-down movement, the same as occurs in its changing altitudinal positions in summer and winter when crossing the meridian.

The Carl Zeiss Works have recently perfected the mechanical equipment of the Planetarium to such a degree that the northern as well as the southern skies may be faithfully reproduced. It is also possible now to project the entire system of the ecliptic, equator and meridians like a finely-drawn network, which greatly aids the orientation of the audience during the course of the lecture.

Quite apart from its value as an astronomical work of precision, there can be no doubt that the installation of an apparatus which com-

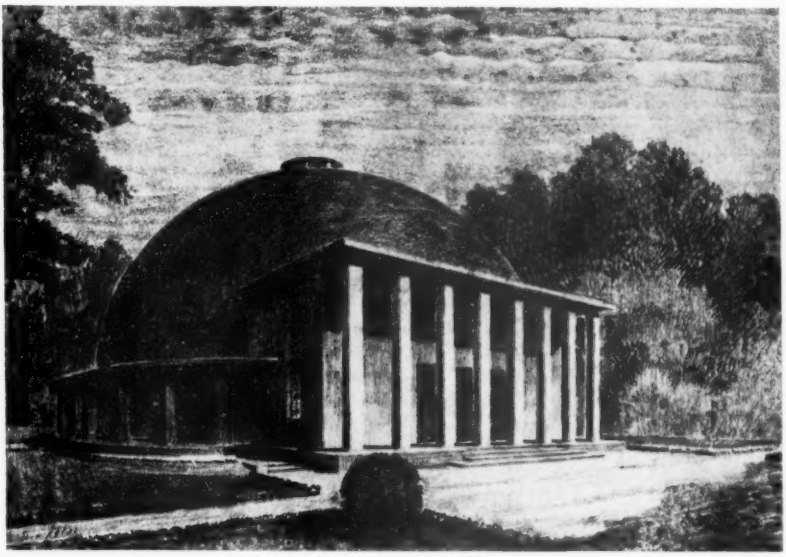

Fig. 9. Zeiss Planetarium Building in Park at Jena, Germany.

presses the cosmic happenings of many years into a few minutes, so that the eye may follow and the mind comprehend the motions of the heavenly bodies as a connected entity, cannot fail to do much to arouse popular interest in the majesty of the universe. Sun, moon and planets, visibly coursing across the celestial dome, must surely make a strong appeal to the imagination of the multitude, and stimulate a desire for knowledge of things which hitherto have not been presented in an intelligibly concrete form. Incidentally, it may be a far from negligible quality of the demonstrations which the Planetarium can furnish, that they are sufficiently spectacular to arrest the attention of the indifferent and fascinate those dwelling on the threshold of enquiry.

If libraries, museums, picture galleries, and educational moving pictures admittedly improve the mind and elevate the moral and esthetic values of a nation, a popular means of beholding and comprehending the moving celestial system (within which our earth is but a speck of the visible universe) cannot fail to possess the highest educational value, intellectually, ethically and esthetically. And, indeed, in a broadly religious sense also; for who could escape the influence of a vision that bids him to—

> "Hold Infinity in the palm of your hand
> and Eternity in an hour."

It is of particular interest to note that the establishment of Zeiss Planetaria has tentatively been discussed for several larger American cities. Six German municipalities have already led the way by contracting for these unique artificial heavens, which will be available to everybody, usually free of charge.

Then ultimately, with everyone genuinely interested in the oldest and best of the physical sciences, as millions who never before cast so much as a skyward glance were staggered on beholding the glories of the recent corona, all shall join with Alfred Noyes in his "Watchers of the Sky":

> "A thousand years
> Are but as yesterday, even unto these.
> How shall men doubt His empery over time
> Whose dwelling is a deep so absolute
> That we can only find them in our souls.
> For there, despite Copernicus, each may find
> The centre of all things. There he lives and reigns,
> There infinite distance into nearness grows,
> And infinite majesty stoops to dust again;
> All things in little, infinite love in man . . . .
> Oh, beating wings, descend to earth once more,
> And hear, reborn, the desert singer's cry:
> "When I consider the heavens, the work of
> Thy fingers,
> The sun and the moon and the stars which Thou
> hast ordained,
> Though man be as dust, I know Thou art mindful
> of him;
> And, through Thy law, Thy light still visiteth him."

PLANET NOTES FOR SEPTEMBER AND OCTOBER.

The *Sun* will move eastward from $10^h\ 38^m$ to $14^h\ 19^m$, passing from the constellation Leo into Virgo, and will end this period near the eastern boundary of this constellation. About the middle of October it will pass very near the bright star Spica. The sun will move from 8° 34′ north of the equator to 13° 52′ south of the equator in these two months. It will cross the equator on September 23.

THE CONSTELLATIONS AT 9:00 P. M. OCTOBER 1.

This is therefore the date of the autumnal equinox, and the beginning of autumn in the northern hemisphere.

October, it is seen, will be favored with two full moons.

The moon will be nearest the earth on September 1 and 29 and on October 25; farthest from the earth on September 13 and October 11.

The phases of the *Moon* will occur as follows:

Full Moon	Sept.	2	at 2 P.M.	C.S.T.
Last Quarter		9	" 6 P.M.	"
New Moon		17	" 10 P.M.	"
First Quarter		25	" 6 P.M.	"
Full Moon	Oct.	1	at 11 P.M.	C.S.T.
Last Quarter		9	" 1 P.M.	"
New Moon		17	" 12 M.	"
First Quarter		24	" 1 P.M.	"
Full Moon		31	" 11 A.M.	"

Mercury will be a morning star in the early part of September. It will reach a point of greatest elongation west of the sun on September 11. On this date Mercury will rise more than an hour before the sun, and will be very near the bright star Regulus. After this date it will move eastward more rapidly than the sun, and will pass the sun on the opposite side from the earth on October 7. It will not become visible again during this period.

Venus will be visible as an evening star during these months. It will be very bright and easily recognizable. About three-fourths of the illuminated surface will be visible from the earth. It will reach a point of greatest elongation east of the sun late in November. Although it is not a particularly satisfactory object to view in a telescope, Venus always attracts attention because of its great brilliancy.

Mars will be east of the sun until September 13 but too near the sun to be seen. On this date the sun will pass the planet but will not move away from it far enough to make the planet visible during these months.

Jupiter will be the most conspicuous object in the sky during these months. At the first of September it will be on the meridian at eight o'clock in the evening, and at the end of October it will cross before five. Its extreme brilliancy attracts the attention on every clear night, and its system of satellites is an unfailing source of interest alike to users of small and of large telescopes. It will be moving westward until September 9, and after that it will take up its regular motion eastward for the remainder of the period. It will be in quadrature with the sun on October 7.

Saturn will be visible in the western sky during September. It will be a short distance east of the sun even at the end of October, but too near the sun to be observed.

Uranus will be at opposition on September 16, and consequently will be visible during these two months. It will be in the constellation Pisces a few degrees south of the equator.

Neptune will be a short distance west of the sun and hence will be in the morning sky. It will be in the constellation Leo, a short distance east of Regulus.

Occultations Visible at Washington.

[From the *American Ephemeris.*]

Date 1925	Star's Name	Magnitude	IMMERSION. Washington C.T.	IMMERSION. Angle from N	EMERSION. Washington C.T.	EMERSION. Angle from N	Duration
			h m	°	h m	°	h m
Sept. 1	31 Capricorni	6.3	0 4	58	1 15	260	1 10
1	39 Aquarii	6.2	20 22	39	21 22	286	1 0
2	ψ Aquarii	4.5	23 28	29	0 33	276	1 5
3	ψ^3 Aquarii	4.6	0 26	99	1 26	203	1 0
10	68 Orionis	5.7	23 25	145	23 48	196	0 23
28	δ Capricorni	3.0	19 7	75	20 25	248	1 18

Date 1925		Star's Name	Magnitude	IMMERSION. Washington C.T.	Angle from N	EMERSION. Washington C.T.	Angle from N	Duration
				h m	°	h m	°	h m
Oct.	1	376 B. Aquarii	6.3	0 1	108	0 51	192	0 50
	7	*m* Tauri	5.0	2 2	153	2 17	172	0 14
	7	B. D. +19°1110	6.0	21 56	95	22 50	241	0 54
	7	χ Orionis	4.5	23 15	11	23 40	323	0 25
	10	79 Geminorum	6.3	3 9	67	4 27	293	1 18
	13	34 Leonis	6.4	2 28	95	3 30	288	1 2
	20	χ Ophiuchi	4.9	17 19	90	18 30	290	1 10
	23	50 Sagittarii	5.5	16 48	69	18 8	280	1 20
	26	50 Aquarii	5.9	17 44	28	18 44	290	0 59
	26	182 B. Aquarii	6.2	21 22	29	22 26	276	1 3
	27	ψ^2 Aquarii	4.6	16 51	29	17 43	290	0 52

Phenomena of Jupiter's Satulites.

VISIBLE AT WASHINGTON.

[From the *American Ephemeris.*]

CENTRAL STANDARD TIME, MIDNIGHT = 0^h

1925	h m			1925	h m		
Sept. 0	18 52	I	Tr. E.	Sept. 15	21 5.5	I	Ec. R.
	19 57	I	Sh. E.	16	18 17	I	Sh. E.
	22 47	III	Oc. D.	18	19 56	III	Tr. I.
4	20 24	III	Sh. E.	20	21 29	II	Oc. D.
	22 10	II	Tr. I.	21	22 11	I	Tr. I.
6	21 16	I	Oc. D.	22	18 39.8	III	Ec. R.
	21 36.0	II	Ec. R.		18 51	II	Sh. I.
7	18 27	I	Tr. I.		19 3	II	Tr. E.
	19 22	IV	Oc. R.		19 28	I	Oc. D.
	19 36	I	Sh. I.		21 36	II	Sh. E.
	20 42	I	Tr. E.	23	17 56	I	Sh. I.
	21 52	I	Sh. E.		18 55	I	Tr. E.
8	19 10.4	I	Ec. R.		20 12	I	Sh. E.
11	19 30	III	Tr. E.	24	20 52.5	IV	Ec. D.
	20 59	III	Sh. I.	29	18 54	II	Tr. I.
13	18 57	II	Oc. D.		19 10.2	III	Ec. D.
14	20 18	I	Tr. I.		21 21	I	Oc. D.
	21 32	I	Sh. I.		21 27	II	Sh. I.
	22 34	I	Tr. E.		21 36	II	Tr. E.
15	19 0	II	Sh. E.				
Oct. 0	18 34	I	Tr. I.	Oct. 15	19 40	I	Oc. D.
	19 52	I	Sh. I.	16	18 12	I	Sh. I.
	20 50	I	Tr. E.		19 11	I	Tr. E.
1	18 50.2	II	Ec. R.		20 29	I	Sh. E.
	19 24.3	I	Ec. R.	17	17 2	III	Sh. I.
2	17 21	IV	Tr. I.		17 43.2	I	Ec. R.
	20 42	IV	Tr. E.		18 40	II	Sh. E.
6	17 54	III	Oc. D.		20 31	III	Sh. E.
	21 18	III	Oc. R.	23	18 52	I	Tr. I.
7	20 29	I	Tr. I.		20 8	I	Sh. I.
8	17 45	I	Oc. D.	24	18 29	II	Sh. I.
9	17 14	I	Tr. E.		18 45	II	Tr. E.
	18 33	I	Sh. E.		19 23	III	Tr. E.
11	18 52.4	IV	Ec. R.		19 38.3	I	Ec. R.
15	18 39	II	Oc. D.	25	16 53	I	Sh. E.

NOTE:—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

VARIABLE STARS.

Minima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of minima in 1925							
					Sept.				Oct.			
	h m	° ′		d h	d h		d h		d h		d h	
SY Androm.	0 08.0	+43 09	9.5—13.0	34 21.8					4 14			
RT Sculptor.	31.5	—26 13	9.6—10.5	0 12.3	1 12		16 21		9 21		25 5	
U Cephei	0 53.4	+81 20	7.0— 9.0	1 11.8	7 5		22 4		7 3		22 2	
Z Persei	2 33.7	+41 46	9.4—12	3 01.4	9 3		21 9		9 17		21 23	
TW Cassiop.	37.6	+65 19	8.2— 9.0	1 10.3	10 19		27 22		6 12		23 16	
RY Persei	39.0	+47 43	8.0—10.3	6 20.7	5 5		18 22		9 12		23 6	
RZ Cassiop.	39.9	+69 13	6.9— 8.1	1 04.7	6 18		21 2		5 10		19 18	
TX Cassiop.	44.4	+62 22	9.4—10.1	2 22.2	9 16		27 5		6 0		23 13	
ST Persei	53.7	+38 47	8.5—10.5	2 15.6	5 7		21 4		7 1		22 23	
RX Cassiop.	2 58.8	+67 11	8.6— 9.1	32 07.6					3 2			
Algol	3 01.7	+40 34	2.3— 3.5	2 20.8	4 0		21 5		8 10		25 15	
RT Persei	16.7	+46 12	9.5—11.5	0 20.4	5 6		18 21		2 11		16 1	
λ Tauri	55.1	+12 12	3.3— 4.2	3 22.9	6 22		22 17		8 13		24 8	
RW Tauri	3 57.8	+27 51	7.1— [11	2 18.5	9 14		26 5		4 12		21 3	
RV Persei	4 04.2	+33 59	9.5—11.0	1 23.4	6 13		22 8		8 2		23 21	
RW Persei	13.3	+42 04	8.8—11.0	13 04.8	6 15		19 20		3 1		29 11	
SZ Tauri	31.4	+18 20	7.2— 7.7	3 03.6	7 4		19 19		8 16		21 6	
RS Cephei	4 48.6	+80 06	9.5—12.0	12 10.1	12 22		25 8		7 18		20 4	
TT Aurigae	5 02.8	+39 27	7.8— 8.7	0 16.0	5 22		19 6		9 6		22 14	
RY Aurigae	11.5	+38 13	10.7—11.7	2 17.5	2 1		18 10		4 18		21 3	
RZ Aurigae	42.9	+31 40	10.6—13.3	3 00.3	8 6		20 7		8 9		20 10	
SV Tauri	45.8	+28 05	9.4—11.0	2 04.0	1 19		19 3		6 11		23 19	
Z Orionis	50.2	+13 40	9.7—10.7	5 04.9	6 3		26 23		7 9		28 4	
SV Gemin.	54.6	+24 28	9.8— [11	4 00.2	5 15		21 15		7 16		23 16	
RW Gemin.	5 55.4	+23 08	9.5—11.0	2 20.8	6 23		24 4		11 8		22 19	
U Columbæ	6 11.2	—33 03	9.2—10.0	2 19.2	4 17		21 12		8 7		25 3	
SX Gemin.	22.0	+20 37	10.8—11.5	1 08.8	7 1		23 10		9 20		26 6	
RW Monoc.	29.3	+ 8 54	9.0—10.8	1 21.7	4 6		19 12		4 18		20 0	
RX Gemin.	43.6	+33 21	8.8— 9.6	12 05.0	10 11		22 16		4 21		29 7	
RU Monoc.	6 49.4	— 7 28	9.8—10.5	0 21.5	4 0		18 9		9 21		24 5	
R Can. Maj.	7 14.9	—16 12	5.8— 6.4	1 03.3	6 17		20 9		4 0		17 15	
RY Gemin.	21.7	+15 52	8.9— [10	9 07.2	1 23		20 14		9 4		27 18	
Y Camelop.	27.6	+76 17	9.5—12	3 07.3	4 23		18 4		8 0		21 6	
TX Gemin.	30.3	+17 08	10.0—11.9	2 19.2	7 19		24 15		3 10		19 19	
RR Puppis	43.5	—41 08	9.4—10.7	6 10.3	9 11		22 8		11 15		24 12	
V Puppis	7 55.4	—48 58	4.1— 4.8	1 10.9	9 1		23 14		8 4		22 17	
X Carinae	8 29.1	—58 53	7.9— 8.7	0 13.0	5 22		22 4		8 10		24 15	
S Cancri	8 38.2	+19 24	8.2—10	9 11.6	5 14		24 13		4 0		23 0	
RX Hydrae	9 00.8	— 7 52	9.1—10.5	2 06.8	5 8		19 1		9 14		23 6	
S Velorum	29.4	—44 46	7.8— 9.3	5 22.4	8 15		20 12		8 7		20 4	
Y Leonis	9 31.1	+26 41	9.3—11.2	1 16.5	7 9		20 21		4 8		24 14	
RR Velorum	10 17.8	—41 36	10.0—10.9	1 20.5	6 16		21 12		13 18		28 14	
SS Carinæ	10 54.2	—61 23	12.2—12.8	3 07.2	5 23		25 18		8 23		22 4	
ST Urs. Maj.	11 22.4	+45 44	6.7— 7.2	8 19.2	4 7		21 21		9 12		27 2	
RW Urs. Maj.	35.4	+52 34	10.3—11.4	7 07.9	9 14		24 6		8 21		23 13	
Z Draconis	11 39.8	+72 49	9.9—13.6	1 08.6	8 11		22 1		12 10		26 0	
RZ Centauri	12 55.6	—64 05	8.5— 8.9	1 21.0	2 11		17 11		2 11		24 23	
RS Can. Ven.	13 06.3	+36 28	7.5—12.5	4 19.1	11 2		30 7		9 21		29 2	
SS Centauri	07.2	—63 37	8.8—10.4	2 11.5	8 3		23 0		7 21		22 18	
SX Hydræ	13 39.0	—26 23	8.6—12.7	2 21.5	5 3		22 12		9 21		21 11	

Minima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of minima in 1925					
					Sept.				Oct.	
	h m	° ′		d h	d h	d h	d h	d h	d h	d h
δ Libræ	14 55.6	— 8 07	4.8— 6.2	2 07.9	8 20	22 19	6 18	27 17		
U Coronæ	15 14.1	+32 01	7.6— 8.7	3 10.9	4 14	18 9	9 4	22 22		
TW Draconis	15 32.4	+64 14	7.3— 8.9	2 19.4	5 7	22 3	8 23	25 19		
SS Libræ	15 43.4	—15 14	9.3—11.5	0 18.4	6 8	20 18	5 3	19 12		
SW Ophiuchi	16 11.1	— 6 44	9.2—10.0	2 10.7	7 3	21 19	6 11	21 3		
SX Ophiuchi	12.6	— 6 25	10.5—11.2	2 01.5	1 8	18 6	4 19	21 7		
R Aræ	31.1	—56 48	6.8— 7.9	4 10.2	4 4	21 21	9 14	27 6		
TT Herculis	16 49.9	+17 00	8.9— 9.3	20 18.1	6 22	27 16	18 10			
TU Herculis	17 09.8	+30 50	9.5—12	2 06.4	6 1	19 14	10 2	23 15		
U Ophiuchi	11.5	+ 1 19	6.0— 6.7	0 20.1	8 19	25 14	12 8	29 3		
μ Herculis	13.6	+33 12	4.6— 5.4	2 01.2	6 12	18 19	7 6	19 14		
TX Herculis	15.4	+42 00	8.3— 9.0	1 00.7	9 16	22 1	10 14	22 22		
RV Ophiuchi	29.8	+ 7 19	9. —12	3 16.5	2 2	16 20	8 23	23 17		
SZ Herculis	36.0	+33 01	9.5—10.3	0 19.6	9 10	25 18	12 3	28 12		
TX Scorpii	48.6	—34 13	7.5— 8.2	0 22.6	4 8	19 10	4 12	27 3		
UX Herculis	49.7	+16 57	8.8—10.5	1 13.2	4 1	19 13	4 0	27 6		
Z Herculis	53 6	+15 09	7.1— 7.9	3 23.8	4 10	20 9	6 8	22 8		
WX Sagittarii	53.6	—17 24	9.2—10.8	2 03.1	8 10	25 1	3 14	20 14		
WY Sagittarii	17 54.9	—23 01	9.5—10.6	4 16.0	6 6	20 6	8 23	22 23		
SX Draconis	18 03.0	+58 23	9.3—10.5	5 04.1	7 3	22 16	8 4	23 16		
RS Sagittarii	11.0	—34 08	5.9— 6.3	2 10.0	4 22	19 10	11 4	25 15		
V Serpentis	11.1	—15 34	9.5—11.1	3 10.9	10 4	24 0	7 19	21 15		
RZ Scuti	21.1	— 9 15	7.4— 8.3	15 03.2	12 11	27 15	13 18	27 21		
RZ Draconis	21.8	+58 50	9.5—10.2	0 13.2	7 16	21 23	6 7	20 15		
RX Herculis	26.0	+12 32	7.0— 7.6	0 21.3	3 5	17 10	8 18	23 0		
SX Sagittarii	39.7	—30 36	8.7— 9.8	2 01.8	6 16	23 7	9 22	26 12		
RR Draconis	40 8	+62 34	9.3—13	2 19.9	5 9	22 8	9 8	26 8		
RS Scuti	43.7	—10 21	9.3—10.3	0 15.9	6 9	19 16	9 14	22 21		
β Lyræ	46.4	+33 15	3.4— 4.1	12 21.8	13 3	26 1	8 23	21 20		
U Scuti	18 48.9	—12 44	9.1— 9.6	0 22.9	7 15	22 22	8 4	23 11		
RX Draconis	19 01.1	+58 35	9.3—10.2	1 21.4	3 21	19 0	11 17	26 21		
RV Lyræ	12.5	+32 15	11. —12.8	3 14.4	3 5	17 14	9 4	23 14		
RS Vulpec.	13.4	+22 16	6.9— 8.0	4 11.4	1 5	19 3	7 1	24 23		
U Sagittæ	14.4	+19 26	6.5— 9.0	3 09.1	8 14	22 3	5 15	19 4		
Z Vulpec.	17.5	+25 23	7.3— 8.5	2 10.9	2 2	16 19	8 22	23 15		
TT Lyræ	24.3	+41 30	9.4—11.6	5 05.8	6 12	22 5	7 23	23 16		
UZ Draconis	26.1	+68 44	9.0— 9.8	1 15.1	7 12	20 13	3 14	23 3		
SY Cygni	19 42.7	+32 28	10. —12	6 00.2	4 4	22 5	4 5	22 5		
WW Cygni	20 00.6	+41 18	9.3—13.4	3 07.6	9 12	22 19	6 1	19 8		
SW Cygni	03.8	+46 01	9. —11.7	4 13.8	5 15	19 8	7 16	21 9		
VW Cygni	11.4	+34 12	9.8—11.8	8 10.3	6 2	22 23	1 9	18 6		
RW Capric.	12.2	—17 59	8.8—10.6	3 09.4	5 19	19 8	9 17	23 6		
UW Cygni	19.6	+42 55	10.5—13	3 10.8	3 10	17 5	7 22	21 17		
V Vulpec.	32.3	+26 15	8.2— 9.8	37 19.0		29 9				
W Delphini	33.1	+17 56	9.4—12.1	4 19.4	8 18	27 23	7 14	26 20		
RR Delphini	38.9	+13 35	10.5—11.8	4 14.4	3 21	22 6	10 16	29 2		
Y Cygni	48.1	+34 17	7.1— 7.9	1 12.0	8 13	26 13	5 12	23 12		
WZ Cygni	49.3	+38 27	9.9—10.8	0 14.0	6 3	21 7	6 12	21 17		
RR Vulpec.	20 50.5	+27 32	9.6—11.0	5 01.2	11 0	21 2	11 8	21 10		
RY Aquarii	21 14.8	—11 14	8.8—10.4	1 23.2	5 0	20 18	6 11	22 5		
UZ Cygni	55.2	+43 52	8.9—11.6	31 07.3		21 6		22 13		
RT Lacertæ	21 57.4	+43 24	9.1—10.5	5 01.7	2 3	22 10	2 13	22 20		
RW Lacertæ	22 40.6	+49 08	10.2—11.2	5 04.4	8 18	24 7	9 20	25 10		
VW Pegasi	51.7	+32 42	10.0—10.6	5 06.4	6 22	22 17	8 13	24 8		
Y Piscium	23 29.3	+ 7 22	9.0—12.0	3 18.4	6 2	21 3	6 5	21 6		
TW Androm.	23 58.2	+32 17	8.6—11.5	4 02.9	3 12	20 0	6 12	22 23		

Maxima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of maxima in 1925							
					Sept.				Oct.			
	h m	° ′		d h	d h		d h		d h		d h	
SX Cassiop.	0 05.5	+54 20	8.6— 9.2	36 13.7			27	23				
SY Cassiop.	0 09.8	+57 52	9.3— 9.9	4 01.7	7	6	23	13	1	16	17	23
RR Ceti	1 27.0	+ 0 50	8.3— 9.0	0 13.3	5	6	20	18	6	5	21	17
RW Cassiop.	1 30.7	+57 15	8.9—11.0	14 19.2	9	20	24	15	11	10	24	5
V Arietis	2 09.6	+11 46	8.3— 9.0	0 23.8	9	3	25	0	10	22	26	18
SU Cassiop.	2 43.0	+68 28	6.5— 7.0	1 22.8	5	9	21	0	14	9	29	23
RW Camelop.	3 46.2	+58 21	8.2— 9.4	16 00.0	8	7	24	17	11	3	27	12
SX Persei	4 10.2	+41 27	10.4—11.2	4 07.0	7	5	24	9	11	12	28	16
SV Persei	42.8	+42 07	8.8— 9.6	11 03.1	3	4	25	9	6	13	28	19
RX Aurigæ	4 54.5	+39 49	7.2— 8.1	11 15.0	2	14	25	20	7	11	30	17
SX Aurigæ	5 04.6	+42 02	8.0— 8.7	1 12.8	8	15	23	23	9	6	24	14
SY Aurigæ	05.5	+42 41	8.4— 9.5	10 03.3	8	20	29	3	9	6	29	12
Y Aurigæ	21.5	+42 21	8.6— 9.6	3 20.6	4	2	19	12	4	23	20	9
RZ Gemin.	5 56.6	+22 15	9.1—10.0	5 12.7	7	17	24	8	10	21	21	23
RS Orionis	6 16.5	+14 44	8.2— 8.9	7 13.6	10	0	25	4	10	7	25	10
T Monoc.	19.8	+ 7 08	5.7— 6.8	27 00.3			15	5	12	5		
RT Aurigæ	23.0	+30 33	5.1— 6.0	3 17.5	4	23	19	20	4	18	19	16
W Gemin.	29.2	+15 24	6.7— 7.5	7 22.0	10	16	26	12	12	8	28	4
ζ Gemin.	6 58.2	+20 43	3.7— 4.3	10 03.7	3	7	23	14	3	18	24	2
RU Camelop.	7 10.9	+69 51	8.5— 9.8	22 06.5			18	20	11	3		
RR Gemin.	7 15.2	+31 04	10.0—11.5	0 09.5	2	2	18	0	3	21	21	19
V Carinae	8 26.7	—59 47	7.4— 8.1	6 16.7	6	10	19	20	9	21	23	7
T Velorum	8 34.4	—47 01	7.6— 8.5	4 15.3	9	18	23	16	12	5	26	3
V Velorum	9 19.2	—55 32	7.5— 8.2	4 08.9	8	2	25	14	4	7	21	19
Z Leonis	9 46.4	+27 22	7.9— 9.6	56 08.7					5	5		
RR Leonis	10 02.1	+24 29	9.1—10.1	0 10.9	5	5	18	19	9	4	22	17
SU Draconis	11 32.2	+67 53	8.9— 9.6	0 15.8	3	21	23	16	6	21	20	2
S Muscae	12 07.4	—69 36	6.4— 7.3	9 15.8	2	21	22	4	1	20	21	4
SW Draconis	12.8	+70 04	8.8— 9.6	0 13.7	1	12	17	11	3	9	19	8
T Crucis	15.9	—61 44	6.8— 7.6	6 17.6	6	1	19	12	2	23	23	4
R Crucis	18.1	—61 04	6.8— 7.9	5 19.8	11	19	23	11	5	3	22	14
S Crucis	12 48.4	—57 53	6.5— 7.6	4 16.6	8	13	22	14	6	16	20	18
W Virginis	13 20.9	— 2 52	8.7—10.4	17 06.5	7	7	24	13	11	19	29	2
SS Hydræ	25.0	—23 08	7.4— 8.1	8 04.8	4	12	20	22	7	7	23	17
RV Urs. Maj.	13 29.4	+54 31	9.2— 9.9	0 11.2	4	9	18	10	9	11	23	12
ST Virginis	14 22.5	— 0 27	10.3—11.4	0 09.9	10	16	25	11	10	7	25	2
V Centauri	25.4	—56 27	6.4— 7.8	5 11.9	4	16	21	4	7	15	24	3
RS Bootis	29.3	+32 11	8.9—10.0	0 09.1	8	12	23	14	8	16	23	19
R Triang.Austr.	15 10.8	—66 08	6.7— 7.4	3 09.3	9	17	23	6	6	19	20	9
S Triang.Austr.	15 52.2	—63 29	6.4— 7.4	6 07.8	7	2	19	17	8	16	21	8
S Normæ	16 10.6	—57 39	6.6— 7.6	9 18.1	8	2	27	15	7	9	26	21
RW Draconis	33.7	+58 03	9.6—10.8	0 10.6	3	8	21	1	8	19	26	12
RV Scorpii	16 51.8	—33 27	6.7— 7.4	6 01.5	4	17	22	21	11	2	23	5
X Sagittarii	17 41.3	—27 48	4.4— 5.0	7 00.3	8	6	22	7	6	7	20	8
Y Ophiuchi	47.3	— 6 07	6.1— 6.5	17 02.9			17	13	4	16	21	19
W Sagittarii	17 58.6	—29 35	4.3— 5.1	7 14.3	1	20	17	0	2	5	25	0
Y Sagitarii	18 15.5	—18 54	5.4— 6.2	5 18.6	6	18	24	2	5	15	22	23
U Sagittarii	26.0	—19 12	6.5— 7.3	6 17.9	4	12	24	19	8	7	21	19
Y Scuti	32.6	— 8 27	8.7— 9.2	10 08.3	4	18	25	11	5	20	26	12
RZ Lyræ	39.9	+32 42	9.9—11.2	0 12.3	7	23	23	7	8	16	24	0
RT Scuti	18 44.1	—10 30	9.1— 9.7	0 11.9	4	11	19	8	4	5	19	2
κ Pavonis	18 46.6	—67 22	3.8— 5.2	9 02.2	9	10	27	15	6	17	24	21
U Aquilæ	19 24.0	— 7 15	6.2— 6.9	7 00.6	7	4	21	6	12	7	26	8

Maxima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of maxima in 1925							
					Sept.				Oct.			
	h m	° ′		d h	d	h	d	h	d	h	d	h
XZ Cygni	19 30.4	+56 10	8.6— 9.3	0 11.2	7	6	21	6	5	6	26	6
U Vulpec.	32.2	+20 07	6.5— 7.6	7 23.5	5	5	21	4	7	3	23	2
SU Cygni	40.8	+29 01	6.2— 7.0	3 20.3	7	22	23	7	8	16	24	1
η Aquilæ	47.4	+ 0 45	3.7— 4.5	7 04.2	7	0	21	8	5	17	20	1
S Sagittæ	51.5	+16 22	5.6— 6.4	8 09.2	3	12	20	7	7	1	23	19
X Vulpec.	19 53.3	+26 17	9.5—10.5	6 07.7	8	20	21	11	10	10	23	1
X Cygni	20 39.5	+35 14	6.0— 7.0	16 09.3	3	8	19	18	6	3	22	12
T Vulpec.	47.2	+27 52	5.5— 6.1	4 10.5	8	13	21	20	5	3	22	21
UY Cygni	52.3	+30 03	9.6—10.4	0 13.5	5	0	25	4	8	15	22	2
RV Capric.	55.9	—15 37	9.2—10.1	0 10.7	3	13	23	17	7	3	20	13
TX Cygni	20 56.4	+42 12	8.5— 9.7	14 17.4	1	10	30	20	15	13	30	6
VY Cygni	21 00.4	+39 34	8.8— 9.5	7 20.6	9	15	25	8	11	1	26	18
SW Aquarii	10.2	— 0 20	9.9—10.8	0 11.0	7	12	21	7	11	23	25	18
VZ Cygni	21 47.7	+42 40	8.2— 9.2	4 20.7	8	0	22	14	7	5	21	19
Y Lacertæ	22 05.2	+50 33	9.1— 9.6	4 07.8	4	12	21	19	9	2	26	9
δ Cephei	25.5	+57 54	3.7— 4.6	5 08.8	10	9	26	12	7	5	23	7
Z Lacertæ	36.9	+56 18	8.2— 9.0	10 21.1	17	14	28	11	9	8	20	6
RR Lacertæ	37.5	+55 55	8.5— 9.2	6 10.1	10	3	22	22	5	18	18	14
V Lacertæ	44.5	+55 48	8.5— 9.5	4 23.6	7	10	22	9	7	8	22	6
X Lacertæ	22 45.0	+55 54	8.2— 8.6	5 10.7	6	15	22	22	9	6	20	4
SW Cassiop.	23 03.7	+58 11	9.2— 9.7	5 10.6	9	0	19	21	6	4	22	12
RS Cassiop	32.6	+61 52	9.0—11.0	6 07.1	4	5	23	2	5	16	24	14
RY Cassiop.	47.2	+58 11	9.3—11.8	12 03.4	11	21	24	0	6	3	30	10
V Cephei	23 51.7	+82 38	6.0— 7.0	0 23.9	7	11	21	10	5	9	19	8

Monthly Report of the American Association of Variable Star Observers, May and June, 1925.

In spite of the frequent remarks from our observers that cloudy weather has prevailed, the volume of material contained in the present double report indicates that even a few observations obtained here and there do, in the long run, make a creditable showing. Over 3,000 observations are here cited, and they represent activities in nearly every quarter of the globe. It is a satisfaction to note that the recently discovered nova in Pictor, too far south to be observed in northern climes, has not been entirely ignored by our contributors. Mr. W. H. Smith, of South Africa, reports two estimates made soon after discovery. Mr. Petrie's maiden list is a very welcome addition. He observes with the Pickering Reflector at Victoria, B. C. Messrs. Baldwin, Chandra, Peltier and Waterfield deserve more than passing mention for their splendid contributions.

A complete account of the recent AAVSO meeting at Leonia, N. J., ably written by Mr. Waldo, will appear in a forthcoming number of Variable Comments.

Secretary Olcott is sojourning in England, where he is officially representing the Association at the meeting of the International Astronomical Union.

The Association feels justly proud of the honors recently bestowed on its sole living, honorary woman member, Miss Annie J. Cannon. Just before sailing for England, Miss Cannon received an honorary LL. D. degree from her Alma Mater, Wellesley College. Then in June, the news reached us that she had received an honorary Dc. S. from Oxford University, the only woman to ever receive such an honor. These degrees were given in recognition of the completion of her work on the Henry Draper Catalogue, in which she has classified the spectra of nearly a quarter of a million stars.

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925.

April 0, J. C. D. 2424241; May 0, J. C. D. 2424271; June 0, J. C. D. 2424302.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
000339 V SCULPTORIS—						
	4225.4	[12.6	Bl	4258.8	[13.3	Bl
001032 S SCULPTORIS—						
	4218.4	10.5	Bl	4225.4	11.1	Bl
001046 X ANDROMEDAE—						
	4264.4	15.0	Wf	4288.4	15.2	Wf
	4269.4	15.2	Wf	4301.4	[13.0	Bi
	4285.4	14.7	Wf	4302.4	14.7	Wf
001755 T CASSIOPEIAE—						
	4289.2	11.8	Pt	4319.2	11.5	Du
	4293.1	12.0	L	4321.3	11.7	Du
	4310.4	12.0	Pt			
001838 R ANDROMEDAE—						
	4264.4	9.5	Wf	4296.4	8.9	Wf
	4269.4	9.1	Wf	4302.4	8.5	Wf
	4281.4	8.8	Wf	4310.4	8 5	Pt
	4285.4	8.9	Wf	4318.3	8.8	Gb
	4288.4	8.8	Wf			
001862 S TUCANAE—						
	4225.4	[13.2	Bl	4258.4	[12.4	Bl
002546 T PHOENICIS—						
	4218.4	11.1	Bl	4225.4	11.8	Bl
002833 W SCULPTORIS—						
	4225.4	[12 2	Bl			
004047 Y CASSIOPEIAE—						
	4264.4	[14.7	Wf	4302.4	[14.5	Wf
	4288.4	[14.5	Wf			
004435 X SCULPTORIS—						
	4218.4	11.9	Bl	4225.4	12.1	Bl
004533 RR ANDROMEDAE—						
	4269.4	[12.6	Wf	4302.4	12.5	Wf
	4288.4	13.0	Wf			
004746a RV CASSIOPEIAE—						
	4264.4	[14.0	Wf	4288.4	14.8	Wf
	4285.4	[14.0	Wf	4302.4	14.4	Wf
004746b — CASSIOPEIAE—						
	4310.4	10.5	Pt			
004958 W CASSIOPEIAE—						
	4281.9	9.6	Lp	4311.0	8.9	Lp
	4289.2	9.0	Pt	4313.3	8.9	Du
	4297.0	9.2	Lp	4317.3	8 9	Du
	4298.2	9.0	Du	4319.2	8.7	Du
	4302.0	8.7	Lp	4321.3	8.9	Du
	4303.4	8.0	Pt			
005475 U TUCANAE—						
	4225.4	[13.8	Bl	4258.4	12.7	Bl
	4236.4	14.0	Bl	4266.4	12.1	Bl
	4245.4	[13.7	Bl	4266.8	11.9	Sm
	4252.4	13.2	Bl			
010630 U SCULPTORIS—						
	4225.4	[12.0	Bl			
010940 V ANDROMEDAE—						
	4264.5	10.4	Wf	4288.4	11.4	Wf
	4269.4	10.6	Wf	4302.4	11.7	Wf
	4281.4	10 8	Wf			
011041 UZ ANDROMEDAE—						
	4269.4	[13.3	Wf	4302.4	15.0	Wf
	4288.4	[14.5	Wf			

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
011272 S CASSIOPEIAE—						
	4256.2	10.1	Wf	4289.2	9.7	Pt
	4262.2	10.0	Wf	4291.1	9.9	Cu
	4268.8	9.9	Wf	4297.0	10 3	Lp
	4269.1	9.9	Du	4302.0	10.3	Lp
	4278.3	9.7	Wf	4303.4	10.0	Pt
	4281.9	10.5	Lp	4306.0	10.3	Lp
	4285.2	9.6	Wf	4311.0	10 5	Lp
	4288.3	9.8	Wf	4321.3	10.3	Du
013238 RU ANDROMEDAE—						
	4269.5	10.8	Wf	4302.4	10.5	Wf
	4288.4	10.7	Wf	4303.4	10.8	Pt
013338 Y ANDROMEDAE—						
	4303.4	10.0	Pt			
014958 X CASSIOPEIAE—						
	4266.1	12 5	Pt	4303.4	13.1	Pt
015354 U PERSEI—						
	4266.1	10.2	Pt	4319.2	8.4	Du
	4303.4	9.2	Pt			
021143a W ANDROMEDAE—						
	4256.2	11.8	Wf	4288.4	12.6	Wf
	4262.2	11.5	Wf	4302.4	12.8	Wf
	4269.2	11.5	Wf	4303.4	12.4	Pt
021258 T PERSEI—						
	4254.6	8.8	Ch	4304.4	8.6	Pt
	4266.1	8.7	Pt	4321.3	8.8	Du
021281 Z CEPHEI—						
	4256.2	13.9	Wf	4285.2	11.6	Wf
	4262.2	13.5	Wf	4291.3	11.2	Wf
	4268.2	13.0	Wf	4304.4	11.0	Pt
	4280.2	11.8	Wf			
021558 S PERSEI—						
	4260.9	11.2	Kl	4304.4	11.4	Pt
	4266.1	11.5	Pt	4312.0	11.5	Lp
	4281.9	11 8	Lp	4313.3	[10.8	Du
	4283.9	11.0	Kl			
022150 RR PERSEI—						
	4256.2	11.3	Wf	4285.2	10.5	Wf
	4262.2	10.9	Wf	4291.3	10.6	Wf
	4266.1	10.8	Pt	4297.3	10.8	Wf
	4268.2	10.7	Wf	4304.4	11.0	Pt
	4280.2	10.4	Wf			
022426 R FORNACIS—						
	4218.4	11.8	Bl	4245.4	[11.9	Bl
	4225.4	12.4	Bl	4258.4	[11.9	Bl
	4236.4	12.5	Bl			
022980 RR CEPHEI—						
	4256.2	15.0	Wf	4288.3	14.9	Wf
	4262.2	15.2	Wf	4291.3	14.7	Wf
	4268.2	[14.9	Wf	4296.3	14.6	Wf
	4280.2	[14.5	Wf	4302.4	14.6	Wf
	4285.2	15.0	Wf			
024356 W PERSEI—						
	4265.1	9 3	Pt	4304.4	9.3	Pt
025050 R HOROLOGII—						
	4218.4	11.1	Bl	4245.4	12.3	Bl
	4225.4	11.3	Bl	4252.4	12.3	Bl
	4236.4	11.9	Bl	4266.4	13.0	Bl

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
025751 T HOROLOGII—						
	4218.4	11.2	Bl	4245.4	[12.7	Bl
	4225.4	11.6	Bl	4258.4	[12.7	Bl
	4236.4	11.5	Bl			
032043 Y PERSEI—						
	4265.1	8.7	Pt	4304.4	8.9	Pt
032335 R PERSEI—						
	4256.2	13.5	Wf	4268.2	13.6	Wf
	4261.2	13.8	Wf			
042209 R TAURI—						
	4252.6	8.2	Ch			
042215 W TAURI—						
	4264.1	10.9	Pt			
042309 S TAURI—						
	4252.6	[10.6	Ch			
043065 T CAMELOPARDALIS—						
	4264.1	9.4	Pt	4290.1	8.8	Pt
	4276.1	8.8	L			
043263 R RETICULI—						
	4218.4	10.3	Bl	4252.4	11.9	Bl
	4225.4	10.4	Bl	4252.7	[12.2	Ht
	4236.4	11.0	Bl	4266.4	12.6	Bl
	4245.4	11.8	Bl	4270.7	[12.2	Ht
	4246.8	12.2	Ht			
043274 X CAMELOPARDALIS—						
	4261.1	8.1	Pt	4290.1	11.2	Pt
043562 R DORADUS—						
	4218.4	5.0	Bl	4252.4	5.4	Bl
	4225.4	5.4	Bl	4252.7	5.5	Ht
	4236.4	5.3	Bl	4265.8	5.2	Sm
	4245.4	5.5	Bl	4266.4	5.2	Bl
	4246.8	5.5	Ht	4270.7	5.8	Ht
043738 R CAELI—						
	4218.4	9.7	Bl	4252.4	8.4	Bl
	4225.4	9.1	Bl	4252.7	8.3	Ht
	4236.4	8.9	Bl	4266.4	8.2	Bl
	4245.4	8.5	Bl	4270.7	8.4	Ht
	4246.8	8.7	Ht			
	4291.1	10.9	Cu			
044349 R PICTORIS—						
	4218.4	8.2	Bl	4252.4	6.7	Bl
	4225.5	8.5	Bl	4258.5	7.6	Bl
	4236.5	8.4	Bl	4266.4	7.8	Bl
	4245.4	7.4	Bl			
044617 V TAURI—						
	4262.2	9.5	Wf	4268.2	10.1	Wf
	4264.1	10.0	Pt			
045514 R LEPORIS—						
	4212.4	7.7	Kk	4230.4	7.9	Kk
	4215.4	7.8	Kk	4231.4	7.9	Kk
	4226.4	7.8	Kk	4232.4	7.7	Kk
	4227.4	7.7	Kk	4233.5	7.9	Kk
	4228.4	7.8	Kk	4234.4	7.9	Kk
	4229.4	8.0	Kk	4252.6	8.5	Ch
050003 V ORIONIS—						
	4252.6	[10.8	Ch			
050022 T LEPORIS—						
	4218.4	10.0	Bl	4245.4	10.5	Bl
	4225.5	10.3	Bl	4252.4	11.0	Bl
	4236.4	10.3	Bl	4266.4	11.0	Bl
050848 S PICTORIS—						
	4218.4	8.3	Bl	4252.4	8.2	Bl
	4225.5	8.0	Bl	4258.5	8.4	Bl
	4236.4	8.6	Bl	4265.7	8.8	Sm
	4245.4	8.5	Bl	4266.4	8.7	Bl
050953 R AURIGAE—						
	4256.3	10.1	Wf	4285.3	8.5	Wf
	4261.1	9.6	Pt	4288.3	8.1	Wf
	4262.2	10.0	Wf	4290.1	7.4	Pt
	4264.1	10.1	Mx	4291.1	8.2	Cu
	4267.4	8.8	Kk	4296.3	7.7	Wf
	4268.2	9.7	Wf	4306.3	7.5	Wf
	4278.3	9.3	Wf			
051247 T PICTORIS—						
	4218.4	8.5	Bl	4252.4	9.0	Bl
	4225.5	8.4	Bl	4265.8	9.5	Sm
	4238.4	8.7	Bl	4252.7	9.2	Ht
	4245.4	8.9	Bl	4266.4	9.9	Bl
	4246.8	9.0	Ht	4270.7	10.0	Ht
051533 T COLUMBAE—						
	4218.4	11.9	Bl	4252.8	11.4	Ht
	4225.5	12.0	Bl	4265.7	10.7	Sm
	4236.4	12.1	Bl	4266.4	10.5	Bl
	4245.4	11.9	Bl	4270.7	10.1	Ht
	4252.4	11.5	Bl			
052034 S AURIGAE—						
	4267.6	9.8	Ch	4290.1	9.3	Pt
052036 W AURIGAE—						
	4261.1	9.3	Pt	4290.1	9.8	Pt
052404 S ORIONIS—						
	4264.1	11.8	Pt			
053005a T ORIONIS—						
	4261.1	10.1	Pt	4266.1	9.9	Pt
	4264.1	9.9	Pt	4272.1	10.1	Pt
	4265.1	9.7	Pt			
053068 S CAMELOPARDALIS—						
	4261.1	9.8	Pt	4290.1	9.8	Pt
053337 RU AURIGAE—						
	4261.1	[12.0	Pt	4290.1	10.0	Pt
	4286.1	11.2	Pt			
053531 Y AURIGAE—						
	4264.1	13.4	Pt			
053920 Y TAURI—						
	4217.8	7.2	Au	4243.8	7.0	Au
	4217.8	7.3	Au	4249.8	7.1	Au
	4221.8	7.1	Au	4249.8	7.2	Au
	4221.8	7.1	Au	4258.8	7.1	Au
	4227.8	6.8	Au	4258.8	7.1	Au
	4243.8	6.9	Au			
054319 SU TAURI—						
	4240.2	10.3	Wf	4268.2	9.7	Wf
	4256.2	10.0	Wf	4269.2	9.7	Wf
	4261.1	10.0	Pt	4270.2	9.8	Wf
	4261.2	9.8	Wf	4272.1	9.8	Pt
	4262.2	9.9	Wf	4278.1	9.8	Pt
	4262.6	9.8	Ch	4279.2	9.6	Wf
	4264.1	9.9	Pt	4279.2	9.6	Bl
	4264.2	9.7	Wf	4280.2	9.6	Bl
	4265.1	9.9	Pt	4280.2	9.6	Wf
	4266.1	9.9	Pt	4283.1	9.7	Pt

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
054331 S CMB—						
	4218.4	11.3	Bl	4252.4	9.3	Bl
	4225.5	11.0	Bl	4252.8	9.6	Ht
	4238.4	9 7	Bl	4265.7	9.7	Sm
	4245.4	9.4	Bl	4266.4	9.4	Bl
	4246.8	9.6	Ht	4270.7	9.9	Ht
054629 R CMB—						
	4225.5	[13.0	Bl	4252.4	12.7	Bl
	4238.4	[13.0	Bl	4265.7	10.2	Sm
	4245.1	13.0	Bl	4266.4	10.5	Bl
054920a U ORI—						
	4231.5	12.1	Kd	4264.1	12.9	Pt
	4262.6	12.4	Ch			
054974 V CAM—						
	4256.3	15.2	Wf	4286.2	[15.2	Wf
	4262.2	15.3	Wf	4283.3	15.4	Wf
	4268.2	15.0	Wf	4291.3	[15.2	Wf
	4283.2	15.2	Wf	4202.4	[15.0	Wf
	4285.3	15.3	Wf			
055353 Z AUR—						
	4256.3	9.8	Wf	4286.1	10.6	Pt
	4261.1	9.8	Pt	4288.3	10.7	Wf
	4262.2	9.8	Wf	4290.1	10.6	Pt
	4266.1	9.8	Pt	4291.3	10.8	Wf
	4268.2	10.2	Wf	4297.3	11.0	Wf
	4278.3	10.5	Wf	4206.3	10.9	Wf
	4285.3	10.5	Wf			
055686 R OCT—						
	4218.4	10.3	Bl	4252.4	11.2	Bl
	4225.5	10.2	Bl	4266.4	11.5	Bl
	4238.5	11.1	Bl	4266.8	11.6	Sm
	4245.5	11.0	Bl			
060450 X AUR—						
	4241.1	8.9	Ro	4260.1	9.0	Ro
	4250.7	9.1	Ch	4267.6	8.8	Ch
	4252.1	8.9	Ro	4268.1	9.1	Pt
	4252.6	8.9	Ch	4290.1	9.1	Pt
	4254.1	9.0	Ro	4300.1	9.9	Cu
	4259.1	9.1	Ro			
060547 SS AUR—						
	4223.2	14.8	Wf	4269.2	14.6	Wf
	4227.2	14.5	Wf	4270.2	[14.5	Wf
	4228.2	[13.9	Wf	4272.1	[12.0	Pt
	4229.3	12.2	Wf	4277.2	[11.0	Pt
	4230.1	11.4	Wf	4278.1	[11.0	Pt
	4233.2	10.9	Wf	4279.2	[12.4	Wf
	4236.4	11.8	Wf	4280.3	[12.4	Wf
	4239.3	13.6	Wf	4281.2	[13.5	Wf
	4240.2	14.2	Wf	4282.2	[13 3	Wf
	4244.2	[13.0	Wf	4283.2	[13.9	Wf
	4246.3	[13.9	Wf	4285.1	[12.4	Pt
	4247.3	[13.9	Wf	4285.2	[14.5	Wf
	4248.2	[13.9	Wf	4286.1	[12 6	Pt
	4249.2	[13.9	Wf	4286.2	14.8	Wf
	4250.3	[13.3	Wf	4287.2	[13.9	Wf
	4252.2	14.8	Wf	4288.3	14.8	Wf
	4253.8	[13.5	L	4289.2	[12 4	Pt
	4254.6	[11.6	Ch	4291.3	[14.5	Wf
	4256.3	14.5	Wf	4292.9	[13.8	L
	4258.2	[13.9	Sg	4294.2	[11.0	Sg
	4259.2	14.7	Wf	4296.3	[13 9	Wf

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
060547 SS AUR—Continued.						
	4260.8	[12.4	L	4297.2	[13.3	Wf
	4261.1	[12.4	Pt	4298.3	[12.4	Wf
	4262.2	14.7	Wf	4300.1	[11.0	Cu
	4263.1	[13.3	Y	4268.3	14.5	Wf
	4264.2	14.8	Wf	4300.1	[11.6	Ks
	4265.1	[12.4	Pt	4302.3	[13.0	Wf
	4266.1	[12.6	Pt	4306.3	[12.4	Wf
	4267.6	[11.6	Ch			
061702 V MON—						
	4212.4	7.3	Kk	4231.5	7.3	Kk
	4215.4	7.4	Kk	4232.5	7.3	Kk
	4226.4	7.3	Kk	4233.4	7.2	Kk
	4227.4	7.2	Kk	4234.5	7.4	Kk
	4228.4	7.3	Kk	4240.4	7.4	Kk
	4229.4	7.4	Kk	4261.1	8.2	Pt
	4230.5	7.4	Kk			
062808 Z MON—						
	4220.9	9.3	Au	4220.9	9.4	Au
063308 R MON—						
	4261.1	10.5	Pt			
063558 S LYN—						
	4261.1	13.5	Pt			
064707 W MON—						
	4261.1	10.0	Pt			
065111 Y MON—						
	4261.1	8.8	Pt	4267.1	8.8	Bi
065208 X MON—						
	4194.4	8 7	Kk	4226.4	7.3	Kk
	4195.4	8.5	Kk	4227.4	7.5	Kk
	4196.5	8.4	Kk	4228.4	7.5	Kk
	4197.6	8.4	Kk	4229.4	7.5	Kk
	4204.4	8.3	Kk	4230.5	7.9	Kk
	4205.4	8 0	Kk	4231.5	7.5	Kk
	4206.4	8.0	Kk	4232.4	7.4	Kk
	4207.4	7.6	Kk	4233.4	7.7	Kk
	4210.4	7.7	Kk	4234.4	7.8	Kk
	4212.4	7.5	Kk	4240.4	7.9	Kk
	4220.8	7 1	Au	4243.9	7.4	Au
	4220.8	6.9	Au	4243.9	7.4	Au
065355 R LYN—						
	4256.3	11.3	Wf	4288.3	9.9	Wf
	4262.2	10.8	Wf	4290.1	9.8	Pt
	4268.2	10.5	Wf	4296.3	9.6	Wf
	4278 3	9.0	Wf	4306.3	9.0	Wf
	4285.3	9.8	Wf			
070122a R GEM—						
	4256.3	11.3	Wf	4283.1	12.3	Bi
	4261.1	11.8	Pt	4283.2	11.8	Wf
	4262.2	11.6	Wf	4286.2	11.8	Wf
	4266.2	11.8	Sg	4288.3	12.0	Wf
	4268 2	12.0	Wf	4296.2	[11.5	Wf
	4279.2	12.1	Wf			
070122b Z GEM—						
	4261.1	12.4	Pt	4290.1	12.4	Pt
	4283.1	12.4	Bi			
070122c TW GEM—						
	4253.6	8.2	Ls	4283.2	8.3	Bi
	4261.1	7.8	Pt	4290.1	8.1	Pt
	4262.5	8.2	Ls			

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
070310 R CANIS MINORIS—				
	4292.8	10.9 L		
070772 R VOLANTIS—				
	4252.8	11.8 Ht	4267.8	12.6 Ht
071713 V GEMINORUM—				
	4261.1	9.1 Pt	4290.1	9.0 Pt
072708 S CANIS MINORIS—				
	4248.6	7.2 Ch	4266.6	7.9 Ch
	4252.1	7.6 Ro	4267.5	8.1 Kk
	4254.6	7.3 Ch	4268.1	8.0 Jo
	4259.1	8.1 Ro	4271.5	8.1 Kk
	4259.5	7.7 Mn	4281.1	8.3 Cy
	4260.1	8.1 Ro	4282.4	8.7 Kk
	4261.1	7.9 Pt	4283.5	8.9 Kk
	4262.1	7.8 Jo	4288.5	9.0 Kk
	4263.0	7.7 Mx	4290.1	8.8 Pt
	4264.2	7.9 Al	4290.5	9.3 Kk
	4266.2	7.9 Sg	4291.8	8.6 L
073173 S VOLANTIS—				
	4218.4	9.4 Bl	4245.5	10.9 Bl
	4225.5	9.8 Bl	4252.4	11.1 Bl
	4238.5	10.6 Bl	4266.4	11.7 Bl
073508 U CANIS MINORIS—				
	4261.1	8.0 Pt	4291.9	9.0 L
	4290.1	8.5 Pt		
073723 S GEMINORUM—				
	4260.6	9.4 Ch	4290.1	10.1 Pt
	4261.1	9.1 Pt		
074241 W PUPPIS—				
	4218.4	10.3 Bl	4252.5	8.8 Bl
	4225.5	9.4 Bl	4252.8	8.9 Ht
	4238.5	9.0 Bl	4265.8	9.2 Sm
	4245.5	8.7 Bl	4266.5	9.1 Bl
	4246.8	9.1 Ht	4267.8	9.2 Ht
074323 T GEMINORUM—				
	4260.6	9.0 Ch	4290.1	9.2 Pt
	4261.1	8.9 Pt		
074922 U GEMINORUM—				
	4242.7	[10.1 Ch	4268.1	11.2 Cy
	4251.7	[10.6 Ch	4268.2	11.3 Wf
	4252.6	[12.3 Ch	4268.3	11.3 Pt
	4254.6	[12.3 Ch	4269.1	12.4 Cy
	4255.7	[12.3 Ch	4269.2	12.4 Bi
	4256.3	14.3 Wf	4269.2	12.0 Wf
	4256.7	[10.4 Ch	4270.2	12.9 Wf
	4257.7	[11.4 Ch	4272.1	[11.7 Pt
	4259.2	14.1 Wf	4278.1	[11.3 Pt
	4260.6	[12.3 Ch	4279.1	[12.4 Cy
	4260.8	[13.0 L	4279.2	[12.9 Wf
	4261.1	[12.4 Pt	4280.2	[13.3 Wf
	4262.2	13.9 Wf	4281.1	[12.4 Cy
	4262.2	[12.3 Ch	4281.2	[13.3 Wf
	4263.1	12.3 Y	4282.2	[13.7 Wf
	4264.0	10.1 Y	4283.1	14.0 Bi
	4264.1	9.5 Pt	4283.2	[13.7 Wf
	4264.1	9.6 Cy	4285.1	[11.7 Pt
	4264.1	9.9 Mx	4285.2	14.0 Wf
	4264.2	9.4 Bi	4286.1	[12.4 Pt
	4264.2	9.1 Wf	4286.2	14.1 Wf
	4265.1	9.5 Cy	4287.2	[13.7 Wf
	4265.1	9.6 Pt	4288.3	14.1 Wf
074922 U GEMINORUM—Continued.				
	4266.1	9.8 Pt	4289.2	[11.7 Pt
	4266.2	10.0 Lv	4290.1	[12.3 Pt
	4266.6	10.1 Ch	4296.3	[13.3 Wf
	4267.1	10.8 Bi	4297.2	[12.3 Wf
	4267.6	10.1 Ch	4299.1	[10.2 Ie
	4268.1	11.5 Lv		
075612 U PUPPIS—				
	4260.6	[10.4 Ch		
081112 R CANCRI—				
	4207.4	8.6 Kk	4262.1	8.0 Ly
	4209.6	7.7 Kk	4264.1	7.8 Cy
	4210.4	7.7 Kk	4265.1	7.8 Mh
	4210.9	8.4 Kb	4266.0	8.0 Kb
	4212.4	7.7 Kk	4266.2	7.8 Mh
	4229.0	7.1 Kb	4267.5	8.6 Kk
	4229.4	7.2 Kk	4267.6	7.6 Ch
	4230.5	6.9 Kk	4268.1	8.2 Ly
	4231.5	6.8 Kk	4281.1	8.3 Cy
	4231.9	7.0 Kb	4282.5	8.5 Kk
	4232.4	6.8 Kk	4283.1	8.7 Ly
	4233.4	6.9 Kk	4283.5	8.6 Kk
	4234.5	6.9 Kk	4286.1	8.6 Ly
	4235.6	6.9 Kk	4288.5	8.8 Kk
	4244.7	6.4 Ch	4289.1	8.7 Ly
	4251.7	6.8 Ch	4290.1	8.6 Cu
	4255.9	7.6 Kb	4290.1	8.6 Pt
	4257.5	7.8 Kk	4290.5	8.5 Mm
	4259.5	7.6 Mm	4290.5	8.9 Kk
	4260.5	7.7 Ch	4291.1	8.7 Mh
	4261.1	7.7 Pt	4291.9	8.0 L
	4261.9	7.8 Kb		
081617 V CANCRI—				
	4261.1	11.8 Pt	4290.1	12.2 Pt
	4264.1	11.2 Cy		
082405 RT HYDRAE—				
	4261.1	8.0 Pt	4290.0	8.0 Pt
082476 R CHAMELEONTIS—				
	4225.5	12.8 Bl	4254.4	12.4 Bl
	4238.5	12.8 Bl	4265.8	12.4 Sm
	4245.5	12.7 Bl	4268.5	11.3 Bl
083019 Y CANCRI—				
	4256.3	12.7 Wf	4283.2	14.1 Wf
	4262.2	13.2 Wf	4283.2	13.4 Bi
	4266.2	13.6 Lv	4285.2	14.4 Wf
	4268.3	13.6 Wf	4291.3	[14.0 Wf
083350 X URSAE MAJORIS—				
	4261.1	10.5 Pt	4285.2	9.5 Lv
	4266.2	10.4 Lv	4290.1	10.1 Pt
	4278.2	10.1 Bi	4315.1	11.3 B
083409 RV HYDRAE—				
	4253.8	7.8 Sh	4261.8	7.9 Sh
	4257.8	7.7 Sh		
084803 S HYDRAE—				
	4255.7	9.9 Pt	4290.1	11.7 Pt
	4261.1	10.8 Pt		
085008 T HYDRAE—				
	4264.1	9.9 Pt	4290.1	9.5 Pt
	4267.6	10.1 Ch	4291.9	9.2 L

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
085120 T CANCRI—				
	4257.7	9.5 Ch	4269.1	9.2 Cy
	4264.1	8.6 Mx	4289.1	9.4 Cy
	4264.1	8.1 Pt	4290.1	8.6 Pt
090151 V URSAE MAJORIS—				
	4315.1	10.4 B		
090425 W CANCRI—				
	4256.3	9.3 Wf	4281.9	10.6 Lp
	4262.2	9.7 Wf	4289.1	10.7 Cy
	4268.3	10.0 Wf	4291.3	10.4 Wf
	4269.1	10.2 Cy	4297.3	11.0 Wf
	4279.2	10.3 Wf	4307.3	11.4 Wf
091868 RW CARINAE—				
	4218.4	12.0 Bl	4245.5	10.2 Bl
	4225.5	11.8 Bl	4252.4	9.6 Bl
	4238.5	10.9 Bl	4268.5	9.9 Bl
092551 V VELORUM—				
	4225.5	13.6 Bl	4252.4	[12.9 Bl
	4238.5	13.5 Bl	4258.5	13.0 Bl
	4245.5	13.5 Bl	4268.6	13.2 Bl
092962 R CARINAE—				
	4218.4	8.9 Bl	4252.4	9.5 Bl
	4225.5	9.1 Bl	4252.8	9.7 Ht
	4238.5	9.2 Bl	4267.8	9.8 Ht
	4245.5	9.5 Bl	4267.8	9.4 Sm
	4246.8	10.0 Ht	4268.6	9.5 Bl
093014 X HYDRAE—				
	4260.6	9.2 Ch	4290.1	10.5 Pt
	4264.1	9.2 Pt		
093178 Y DRACONIS—				
	4262.1	9.4 Du	4308.2	9.0 Cy
	4263.0	9.3 Y	4309.1	8.7 Du
	4263.2	9.9 Cy	4310.1	8.8 Du
	4269.1	9.2 Cy	4313.1	9.0 Du
	4269.1	9.2 Du	4314.1	9.0 Du
	4274.2	9.1 Br	4315.1	9.1 Du
	4289.1	8.5 Cy	4316.2	9.1 Du
	4298.1	8.8 Cy	4319.1	9.2 Du
	4298.2	8.6 Du	4319.2	9.3 Cy
	4299.1	8.6 Du	4321.3	9.1 Du
093934 R LEONIS MINORIS—				
	4244.7	7.0 Ch	4266.8	7.2 Ch
	4252.6	7.3 Ch	4269.1	7.7 Al
	4254.1	7.4 Ro	4289.2	8.6 Cy
	4265.1	7.7 Pt	4290.1	8.2 Cu
094211 R LEONIS—				
	4225.6	8.2 Kk	4267.4	6.1 Wb
	4226.6	8.2 Kk	4267.5	6.3 Kk
	4227.6	8.1 Kk	4268.1	6.0 Ly
	4228.4	8.2 Kk	4268.1	5.8 Jo
	4229.5	8.2 Kk	4268.2	6.0 Wb
	4230.5	8.2 Kk	4268.5	6.3 Kk
	4231.5	8.1 Kk	4269.1	5.8 Ly
	4231.9	6.8 Kb	4269.2	6.0 Wb
	4232.5	8.1 Kk	4271.5	6.5 Kk
	4233.4	8.1 Kk	4271.5	6.6 Kd
	4234.0	6.6 Kb	4273.1	5.9 Jo
	4234.5	8.1 Kk	4279.2	6.0 Wb
	4235.6	8.1 Kk	4281.1	6.5 Cy
	4240.4	7.0 Kk	4282.4	6.5 Kk

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
094211 R LEONIS—Continued.				
	4240.5	6.7 Kd	4283.1	6.8 Ly
	4241.1	6.4 Ro	4283.1	6.0 Wb
	4244.7	5.8 Ch	4283.5	7.5 Kk
	4247.2	6.4 Wb	4284.5	7.5 Kk
	4252.1	6.2 Ro	4284.6	6.7 Kd
	4252.2	6.2 Wb	4286.1	6.7 Ly
	4254.1	6.0 Ro	4286.2	6.0 Wb
	4254.2	6.1 Wb	4287.2	6.3 Mh
	4254.4	6.4 Kd	4287.5	7.1 Kd
	4255.5	6.2 Kk	4288.5	7.4 Kk
	4256.5	6.3 Kk	4289.1	6.6 Jo
	4256.6	6.3 Kk	4289.1	6.9 Ly
	4257.5	6.3 Kk	4289.1	5.8 Al
	4257.5	6.5 Kd	4290.2	6.4 Pt
	4257.7	5.8 Ch	4290.5	7.4 Kk
	4258.5	6.3 Kk	4290.5	6.7 Mm
	4259.1	6.0 Ro	4291.1	6.6 Mh
	4259.5	5.5 Mm	4291.2	6.1 Wb
	4259.6	6.2 Kk	4292.5	7.6 Kd
	4260.1	6.0 Ro	4292.5	7.5 Kk
	4262.1	6.2 Ly	4294.2	6.2 Wb
	4262.1	6.4 Jo	4296.2	6.2 Wb
	4263.0	5.8 Mx	4297.1	6.6 Ly
	4263.1	5.8 Al	4297.2	6.2 Sg
	4263.6	6.3 Kk	4300.1	6.4 Al
	4266.0	6.5 Kk	4302.1	7.3 Mh
	4266.2	5.9 Mh	4303.2	6.2 Wb
	4266.2	6.0 Sg	4311.1	7.2 Ly
	4264.1	5.8 Al	4312.1	7.4 Mh
	4265.1	5.8 Pt	4313.1	7.0 Cy
	4265.1	5.8 Mh	4314.1	7.5 Mx
	4265.1	6.0 Jo	4318.1	7.3 Ly
	4265.4	6.5 Kk	4318.2	6.8 Wb
094622 Y HYDRAE—				
	4265.1	6.8 Pt		
094953 Z VELORUM—				
	4218.4	10.3 Bl	4252.4	11.4 Bl
	4225.5	10.6 Bl	4252.8	11.9 Ht
	4238.5	11.0 Bl	4267.8	12.1 Ht
	4245.5	11.0 Bl	4267.8	12.5 Sm
	4246.8	11.9 Ht	4268.6	11.7 Bl
095421 V LEONIS—				
	4256.3	13.9 Wf	4281.1	13.8 Lv
	4262.2	13.9 Wf	4283.2	14.1 Wf
	4266.2	13.8 Lv	4288.3	13.9 Wf
	4266.2	[12.6 Sg	4296.3	14.0 Wf
	4268.3	14.1 Wf	4307.3	[13.2 Wf
	4269.2	13.9 Bi		
095563 RV CARINAE—				
	4218.4	11.7 Bl	4245.5	11.2 Bl
	4225.5	11.4 Bl	4252.4	11.3 Bl
	4238.5	11.1 Bl	4268.6	11.5 Bl
095814 RY LEONIS—				
	4256.9	8.6 Kl	4269.9	8.7 Kl
	4258.0	8.6 Kl	4270.9	8.6 Kl
	4260.9	8.6 Kl	4271.0	8.5 Kl
	4261.9	8.7 Kl	4276.9	8.6 Kl
	4262.9	8.7 Kl	4283.9	8.8 Kl
	4267.0	8.9 Kl		

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
100661 S CARINAE—				
	4218.5	7.3 Bl	4252.4	7.8 Bl
	4225.5	7.6 Bl	4252.8	8.0 Ht
	4238.5	8.2 Bl	4267.8	6.8 Ht
	4245.5	8.4 Bl	4267.8	6.5 Sm
	4246.8	8.7 Ht	4268.6	6.5 Bl
100860 U URSAE MAJORIS—				
	4244.8	6.2 Au	4258.8	6.4 Au
101058 Z CARINAE—				
	4227.4	[12.6 Bl	4258.5	[12.6 Bl
	4267.8	[11.8 Sm		
101153 W VELORUM—				
	4227.4	12.7 Bl	4267.9	[12.0 Sm
	4258.5	[13.0 Bl		
103212 U HYDRAE—				
	4227.6	5.9 Kk	4240.6	5.8 Kk
	4228.5	5.8 Kk	4257.5	6.0 Kd
	4229.6	5.1 Kk	4271.5	5.9 Kd
	4230.6	5.9 Kk	4282.5	6.1 Kd
	4231.6	5.6 Kk	4287.5	6.1 Kd
	4235.6	5.5 Kk	4292.5	6.0 Kd
	4240.5	5.9 Kd		
103769 R URSAE MAJORIS—				
	4236.4	9.2 Wf	4288.3	11.8 Wf
	4254.6	10.5 Ch	4289.2	11.0 Al
	4262.2	11.0 Wf	4290.1	11.9 Cu
	4263.1	10.8 Al	4290.2	11.8 Pt
	4264.1	11.0 Mx	4292.1	11.8 Cy
	4265.1	10.9 Pt	4296.3	12.0 Wf
	4265.3	10.8 Sg	4297.2	11.7 Sg
	4268.2	11.0 Lv	4299.1	12.2 Ie
	4268.3	11.1 Wf	4307.3	12.3 Wf
	4269.2	11.3 Cy	4309.2	12.2 Cy
	4278.2	11.0 Bi	4314.3	12.4 Sg
	4278.3	11.5 Wf	4315.2	12.2 Cy
	4285.3	11.6 Wf	4318.1	12.3 Bi
104620 U HYDRAE—				
	4218.5	11.8 Bl	4258.5	12.2 Bl
	4225.5	11.9 Bl	4265.1	11.6 Pt
	4238.5	12.1 Bl	4266.6	[11.0 Ch
	4245.5	12.6 Bl	4268.6	12.1 Bl
	4252.5	12.4 Bl	4290.2	11.5 Pt
104628 RS HYDRAE—				
	4225.5	14.0 Bl	4252.5	12.7 Bl
	4238.5	13.3 Bl	4268.6	12.5 Bl
	4245.5	13.2 Bl		
104814 W LEONIS—				
	4264.2	10.1 Cy	4283.1	10.4 Y
	4265.1	9.9 Pt	4292.1	10.3 Cy
	4266.2	9.5 Lv	4295.2	10.1 Pt
	4269.2	9.9 Bi	4298.1	10.4 Cy
	4281.1	10.1 Lv	4315.1	11.2 B
110361 RS CARINAE—				
	4265.8	[12.3 Sm		
110506 S LEONIS—				
	4257.6	11.3 Kd	4281.1	11.8 Cy
	4260.5	11.5 Kd	4292.1	12.0 Cy
	4262.2	11.2 Cy	4295.2	11.9 Pt
	4265.1	11.2 Pt	4298.1	12.4 Cy
	4269.2	11.4 Cy		
111561 RY CARINAE—				
	4225.5	[13.5 Bl	4258.5	[13.1 Bl
111661 RS CENTAURI—				
	4218.5	8.9 Bl	4252.5	10.5 Bl
	4220.5	9.1 Bl	4258.6	11.5 Bl
	4238.5	9.1 Bl	4265.8	12.0 Sm
	4245.5	9.5 Bl	4268.6	12.5 Bl
114441 X CENTAURI—				
	4227.4	[13.1 Bl	4252.5	12.7 Bl
	4238.5	13.5 Bl	4268.6	12.5 Bl
	4245.6	12.8 Bl		
115058 W CENTAURI—				
	4218.5	10.8 Bl	4245.6	9.3 Bl
	4225.5	10.5 Bl	4252.5	9.1 Bl
	4238.5	9.9 Bl	4268.6	8.9 Bl
115905 RX VIRGINIS—				
	4244.9	8.4 Au	4264.9	8.3 Sh
	4249.9	8.5 Au	4284.9	8.8 Sh
	4257.8	8.3 Sh	4286.9	8.9 Sh
	4258.8	8.6 Au	4291.9	8.8 Sh
	4258.8	8.5 Au	4296.9	8.8 Sh
	4261.8	8.1 Sh		
115919 R COMAE—				
	4227.3	13.4 Wf	4280.2	9.5 Lv
	4233.3	13.1 Wf	4281.1	9.3 Lv
	4240.3	12.5 Wf	4285.3	9.0 Wf
	4246.3	12.6 Wf	4291.3	9.1 Wf
	4256.3	11.7 Wf	4292.2	8.6 Cy
	4262.2	10.9 Wf	4295.2	8.9 Pt
	4264.2	10.9 Cy	4297.2	9.0 Sg
	4265.1	10.7 Pt	4297.3	8.8 Wf
	4266.2	10.7 Lv	4307.3	8.7 Wf
	4268.3	10.4 Wf	4313.1	9.2 Ya
	4269.2	9.5 Bi	4318.1	9.0 B
	4279.2	9.4 Wf		
120012 SU VIRGINIS—				
	4298.2	12.4 Cy	4315.1	11.9 B
	4313.2	12.2 Cy		
120206 RW VIRGINIS—				
	4244.9	7.5 Au	4284.9	7.4 Sh
	4257.8	7.7 Sh	4286.9	7.5 Sh
	4258.8	7.1 Au	4291.9	7.6 Sh
	4261.8	7.6 Sh	4296.9	7.6 Sh
	4264.9	7.5 Sh		
120905 T VIRGINIS—				
	4265.1	10.9 Pt	4292.2	9.8 Cy
	4266.2	10.4 Lv	4295.2	11.0 Pt
	4268.2	10.4 Lv	4311.1	10.4 B
	4269.2	10.3 Bi	4313.2	11.0 Cy
	4281.2	10.1 Lv	4315.1	10.5 B
121418 R CORVI—				
	4265.1	13.7 Pt	4311.1	12.3 B
	4292.9	13.3 L		
122001 SS VIRGINIS—				
	4215.8	8.8 Kd	4240.6	9.3 Kd
	4230.5	8.9 Kd	4291.6	8.0 L

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
122532 T CANUM VENATICORUM—				
	4263.2	10.9 Al	4295.2	11.6 Pt
	4265.1	10.3 Pt	4298.2	12.0 Cy
	4281.9	11.3 Lp	4301.9	11.6 Lp
	4287.9	11.6 Lp	4310.9	11.9 Lp
	4289.2	11.8 Al		
122803 Y VIRGINIS—				
	4292.9	13.9 L	4311.1	[13.0 B
122854 U CENTAURI—				
	4227.4	[12.4 Bl	4252.5	11.6 Bl
	4238.5	12.7 Bl	4258.5	11.0 Bl
	4245.6	12.7 Bl	4268.6	10.1 Bl
123160 T URSAE MAJORIS—				
	4262.2	12.5 Wf	4311.0	8.2 Lp
	4265.1	12.4 Pt	4312.1	8.1 Mh
	4268.3	12.1 Wf	4312.2	7.6 Ya
	4283.3	10.7 Wf	4313.1	8 1 Ly
	4285.3	10.0 Wf	4314.	8.1 Ro
	4288.3	10.2 Wf	4314.1	8.5 Al
	4291.2	10.0 Mh	4314.1	8.1 Mx
	4295.2	9.5 Pt	4314 3	8.0 Sg
	4295.2	9.7 Mh	4314.2	8.3 Jo
	4296.3	9.5 Wf	4315.1	7.8 B
	4296.3	9.6 Sg	4315.2	8.0 Jo
	4297.1	9.5 Ly	4316.3	8 1 Mh
	4297.2	8.6 Gb	4318.	7.8 Ro
	4298.	9.2 Ro	4318.1	8.0 Ly
	4302.2	9.0 Cu	4318.2	7.5 Gb
	4307.3	8.4 Wf	4319.1	8.1 Jo
	4309.2	8.3 Cy	4321.1	7.9 Jo
123307 R VIRGINIS—				
	4260.6	7.7 Ch	4289.2	9.0 Cy
	4265.1	8.4 Pt	4291.2	10.1 Mh
	4266.2	8.1 Pt	4291.9	10.4 L
	4267.5	8.9 Kk	4295.2	10.3 Pt
	4271.5	9.1 Kk	4298.2	10.8 Cy
	4282.5	9.9 Kk	4312.1	11.0 Ya
	4283.5	9.7 Kk	4315.1	10.7 B
	4288.5	9.7 Kk	4316.3	10.5 Mh
123459 RS URSAE MAJORIS—				
	4226.2	9.4 Kk	4266.8	9.5 Ch
	4227.6	9.4 Kk	4267.5	9.9 Kk
	4228.5	9.3 Kk	4268.1	9 9 Ly
	4229.5	8.9 Kk	4268.1	10.2 Cy
	4230.5	9.2 Kk	4268.2	10.5 Lv
	4231.5	9.2 Kk	4268.2	10.5 Lv
	4232.5	9.1 Kk	4268 3	10.1 Wf
	4233.4	9.0 Kk	4269.0	10.0 Du
	4234.5	8.9 Kk	4273.2	9.8 Jo
	4235.6	8.9 Kk	4278.2	10.4 Bi
	4240.4	8.8 Kk	4279.1	10.5 Cy
	4242.8	8.9 Kk	4280.3	10.6 Wf
	4245.7	9.2 Ch	4283.1	10.8 Ly
	4246.3	9.1 Wf	4285.3	10.9 Wf
	4256.6	8.9 Kk	4289.1	10.9 Al
	4257.6	8.9 Kk	4289.2	10.2 Jo
	4258.5	8.9 Kk	4289.2	11.3 Cy
	4259.5	9.5 Mm	4291.3	11.5 Wf
	4259.6	9.2 Kk	4295.2	11.7 Pt
	4260.6	9.4 Ch	4297.2	11.7 Sg
	4262.0	9.6 Du	4297.3	11.7 Wf

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
123459 RS URSAE MAJORIS—Continued.				
	4262.2	9.7 Wf	4298.2	11.4 Cy
	4263.0	9.7 Du	4307.3	12.0 Wf
	4263.2	9.9 Cy	4309.2	12.4 Cy
	4263.2	9.3 Al	4314.3	12.6 Sg
	4263.6	9.5 Kk	4315.2	12 9 B
	4264.1	9.5 Mx	4315.2	12 8 Cy
	4265.1	9.9 Pt	4318.1	13.0 Bi
	4265.3	9.5 Sg	4319.2	13.1 Cy
123556 Y URSAE MAJORIS—				
	4244.8	9.2 Au	4258.9	9.0 Au
123961 S URSAE MAJORIS—				
	4210.9	8.7 Kb	4271.5	8.5 Kk
	4225.7	8.4 Kk	4276.1	8.0 L
	4226.6	8.5 Kk	4278.2	7.7 Bi
	4227.6	8.4 Kk	4278.3	8.3 Wf
	4228.4	8.3 Kk	4282.4	8.6 Kk
	4229.0	8.3 Kb	4283.1	8.6 Ly
	4229.4	8.3 Kk	4283.5	8.7 Kk
	4230.5	8.3 Kk	4285.3	8.5 Wf
	4231.5	8.3 Kk	4285.9	8.8 Lp
	4232.5	8.1 Kk	4286.1	8.6 Ly
	4233.4	8.3 Kk	4288.3	8.7 Wf
	4234.5	8.4 Kk	4288.5	8.7 Kk
	4235.6	8.4 Kk	4289.1	8.4 Al
	4240.4	8.1 Kk	4289.1	8.6 Ly
	4241.1	7.8 Ro	4289.2	8.6 Cy
	4242.8	8.1 Kk	4290.5	8.7 Kk
	4250.7	8.2 Ch	4291.2	8.6 Mh
	4252.1	7.5 Ro	4292.6	8.7 Kk
	4254.1	8.0 Ro	4295.2	8.7 Pt
	4255.5	8.1 Kk	4295.2	8.8 Mh
	4255.9	8.2 Kb	4296.3	8.8 Wf
	4256.6	8.1 Kk	4296.3	8.6 Sg
	4256.9	8.0 Kl	4297.1	8.8 Ly
	4257.6	8.1 Kk	4297.2	8.6 Gb
	4258.5	8.2 Kk	4298.	8.5 Ro
	4259.1	7.3 Ro	4301.9	9.2 Lp
	4259.5	8.3 Mm	4302.1	8.7 Mh
	4259.7	8.2 Kk	4302.2	8.8 Cu
	4260.1	7.3 Ro	4307.3	8.5 Wf
	4261.9	8.2 Kb	4309.2	8.9 Cy
	4262.0	8.2 Du	4311.0	9.4 Lp
	4262.3	8.3 Wf	4312.1	9.3 Mh
	4263.0	8.2 Du	4312 2	9.3 Ya
	4263.2	8.2 Al	4313.1	9.2 Ly
	4263.6	8.5 Kk	4314.	8.8 Ro
	4264.0	7.8 Mx	4314.1	9.2 Mx
	4264.5	8.5 Kk	4314.1	8.6 Al
	4265.1	8.0 Pt	4314.2	8.6 Jo
	4265.3	8.3 Sg	4314.3	9.1 Sg
	4266.0	7.7 Kb	4315.1	8.4 Jo
	•4266.2	8.5 Mh	4315.1	9.1 B
	4266.8	8.2 Ch	4316.3	9.2 Mh
	4267.5	8.5 Kk	4318.	9.0 Ro
	4268.1	8.3 Ly	4318.1	9.1 Ly
	4268.2	8.1 Lv	4318.1	9.1 Bi
	4268.3	8.2 Wf	4318.2	9.2 Gb
	4268.5	8.5 Kk	4319.1	8.8 Jo
	4269.0	8.2 Du	4321.1	8.9 Jo
	4270.0	8.3 Kl		

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
124204 RU VIRGINIS—						
	4263.1	10 8	Mx	4295.2	10.5	Pt
	4265.1	10.3	Pt	4298.2	11.0	Cy
	4269.2	11.0	Cy			
124606 U VIRGINIS—						
	4263.0	8.0	Mx	4298.2	7.7	Cy
	4265.1	7.7	Pt	4314.1	8.9	Mx
	4269.2	7.7	Cy	4318.1	9 0	Ya
	4295.2	7.9	Pt	4318.1	8.8	B
130212 RV VIRGINIS—						
	4256.3	[13.6	Wf	4285.3	14.9	Wf
	4262.3	[15.0	Wf	4286.3	14.7	Wf
	4263.2	[13.1	Cy	4288.3	[14 5	Wf
	4264.3	[14.5	Wf	4291.3	14.8	Wf
	4267.3	[13.3	Br	4296.3	14.7	Wf
	4268.3	[14.5	Wf	4298.2	[12.1	Cy
131283 Y OCTANTIS—						
	4227.4	12.6	Bl	4265.8	10 0	Sm
	4258.6	11.0	Bl	4268.6	10.3	Bl
132202 V VIRGINIS—						
	4263.3	9.5	Cy	4315.1	12.5	B
	4267.3	9.8	Br			
132422 R HYDRAE—						
	4212.1	7.9	Kk	4259.6	5.5	Kd
	4218.5	7 0	Bl	4260.5	5.5	Kd
	4225.5	7.3	Bl	4265.1	4.4	Pt
	4225.6	7.5	Kk	4265.7	5.3	Ch
	4227.6	7.5	Kk	4265.8	4.8	Sm
	4228.6	7.5	Kk	4267.6	5.0	Ch
	4229.6	7 7	Kk	4268.6	5.0	Pl
	4230.6	7.3	Kk	4271.5	4.8	Kd
	4231.6	7.1	Kk	4272.4	4.9	Kd
	4235.6	7.1	Kk	4275.5	4.6	Kd
	4238.5	6.7	Bl	4282.5	4.9	Kd
	4240.6	7 3	Kk	4283.5	4.8	Kd
	4240.6	7.0	Kd	4284.6	4.7	Kd
	4243.6	6.8	Kd	4287.5	4.8	Kd
	4244.7	6.2	Ch	4288.5	4.9	Kd
	4245.6	6.0	Bl	4290.6	4.8	Kd
	4252.5	5 5	Bl	4291.9	4.6	L
	4254.5	6.0	Kd	4292.5	5.0	Kd
	4255.7	5.7	Ch	4295.2	4.7	Pt
	4258.5	5.7	Kd	4295.6	5.0	Kd
132706 S VIRGINIS—						
	4212.7	9.4	Kk	4275.6	6.8	Kk
	4225.6	8 9	Kk	4279.3	6.8	Wf
	4226.6	8.9	Kk	4283.2	7.2	Wb
	4227.6	8.9	Kk	4283.5	6.8	Kk
	4228.5	8.9	Kk	4285 3	6.8	Wf
	4229.6	8.6	Kk	4287.2	6.9	Mh
	4230.6	8 8	Kk	4288.3	6.9	Wf
	4231.6	8.6	Kk	4288.5	6.9	Kk
	4235.6	8.6	Kk	4289.2	6.7	Al
	4240.6	8.2	Kk	4291.2	6.7	Mh
	4247.7	7.7	Ch	4292.6	7.0	Kk
	4255.7	7.4	Ch	4295.2	7.0	Mh
	4256.3	7.0	Wf	4295.2	7.2	Pt
	4257.5	6.0	Kk	4296.2	7.2	Wb
	4259.5	7.1	Mm	4296.3	7.0	Wf
	4259.6	6.8	Kk	4297.2	7.7	Sg
	4262.3	6.8	Wf	4298.3	7.2	Wb
132706 S VIRGINIS—Continued.						
	4263.2	7.0	Cy	4301.1	7.5	Mh
	4265.1	7.3	Pt	4306.3	7.2	Wf
	4265.5	6.7	Kk	4307.2	7.5	Wb
	4265.8	6.8	Sm	4309.1	7.1	Al
	4266.2	7 3	Mh	4312.1	7.5	Mh
	4266.2	6.6	Sg	4313.1	7.4	Ya
	4267.3	7.0	Br	4313.2	8.1	Cy
	4267.6	6.7	Ch	4316.3	7.8	Mh
	4268.1	6.8	Al	4318.2	7.9	B
	4268.3	6 8	Wf	4318.2	7.9	Wf
	4268.5	6.7	Kk			
133155 RV CENTAURI—						
	4218.5	8.8	Bl	4245.6	9.3	Bl
	4225.5	8.9	Bl	4252.6	9.0	Bl
	4238.5	9.0	Bl	4268.6	9.4	Bl
133273 T URSAE MINORIS—						
	4262.3	11.2	Wf	4286 3	12 5	Wf
	4261.3	11.7	Wf	4291.3	12.7	Wf
	4269.1	11.0	Jo	4297.3	12.7	Wf
	4282.2	12.0	Wf	4318.2	13.4	Bi
133633 T CENTAURI—						
	4218.5	6.5	Bl	4257.6	6 6	Kd
	4225.5	6.2	Bl	4258.5	6.7	Kd
	4238.5	5.8	Bl	4259.6	6.7	Kd
	4240.6	5.8	Kd	4260.5	6.7	Kd
	4245.6	6.0	Bl	4267.8	7.8	Ht
	4246.8	6.2	Ht	4268.6	7.7	Bl
	4252.6	6.0	Bl	4287.6	8.6	Kd
	4252.8	6.5	Ht	4292.5	8.4	Kd
	4254.5	6.5	Kd			
134236 RT CENTAURI—						
	4218.5	9 1	Bl	4245.6	10.7	Bl
	4225.5	9.4	Bl	4252.5	10.8	Bl
	4238.5	10.0	Bl	4268.6	11.6	Bl
134440 R CANUM VENATICORUM—						
	4265.1	10.3	Pt	4296.9	11.1	Lp
	4268.1	10.7	Lv	4299.1	11.0	Ie
	4281.3	10 6	Bi	4299.2	10.8	Bi
	4281.9	10.8	Lp	4310.9	11.3	Lp
	4286.2	10.4	Bi	4313.1	10.8	Ya
	4287.9	11.2	Lp	4314.1	11.2	Cu
	4295.2	10.7	Mh	4318.2	10.9	Bi
	4295.2	11.1	Pt			
134536 RX CENTAURI—						
	4227.4	13.1	Bl	4258.7	[13.1	Bl
	4238.5	[13.5	Bl			
134677 T APODIS—						
	4218.5	12.7	Bl	4266.8	[12.3	Sm
	4227.4	[13.2	Bl	4268.6	[13.2	Bl
	4258.6	[13.3	Bl			
135908 RR VIRGINIS—						
	4262.3	12 4	Cy	4267.3	12.7	Br
	4265.1	12.1	Pt	4295.2	13.5	Pt
140113 Z BOOTIS—						
	4256.3	10.1	Wf	4285.3	11.6	Wf
	4262.3	10.1	Wf	4291.3	11.6	Wf
	4267.3	10.5	Br	4297.3	12.2	Wf
	4268.3	10 4	Wf	4307.3	12.8	Wf
	4280 3	11.1	Wf	4315.2	12.8	Cy

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
140512 Z VIRGINIS—						
	4265.1	[12.8	Pt	4297.2	13.4	Pt
140528 RU HYDRAE—						
	4218.5	8.6	Bl	4252.5	8.9	Bl
	4225.5	8.6	Bl	4265.8	9.7	Sm
	4238.5	8.8	Bl	4268.6	9.4	Bl
	4245.6	8.9	Bl			
140959 R CENTAURI—						
	4218.5	8.4	Bl	4252.8	6.1	Ht
	4225.5	8.0	Bl	4258.6	5.5	Bl
	4238.5	7.0	Bl	4265.8	5.9	Sm
	4245.6	6.0	Bl	4267.8	5.9	Ht
	4246.8	6.5	Ht	4268.6	5.8	Bl
	4252.5	5.8	Bl			
141567 Y URSAE MINORIS—						
	4260.6	10.2	Ch	4297.1	11.8	Pt
	4262.1	10.3	Du	4315.1	11.0	Cu
	4265.1	10.2	Pt	4315.2	11.4	Cy
	4269.1	10.4	Jo	4318.2	11.9	Bi
141954 S BOOTIS—						
	4227.3	13.6	Wf	4285.2	11.6	Wf
	4233.3	13.5	Wf	4288.3	11.6	Wf
	4239.3	13.5	Wf	4291.1	10.4	L
	4246.3	13.4	Wf	4296.3	10.5	Wf
	4256.3	12.8	Wf	4297.1	10.6	Pt
	4258.2	12.6	Sg	4298.2	10.5	Cy
	4262.3	12.6	Wf	4307.2	10.3	Cu
	4265.1	12.1	Pt	4307.3	10.4	Wf
	4267.3	12.7	Br	4314.3	10.4	Sg
	4268.3	12.5	Wf	4318.2	10.0	Gb
	4282.2	11.6	Wf	4321.1	9.8	Cu
142205 RS VIRGINIS—						
	4267.3	9.8	Br			
142539 V BOOTIS—						
	4250.6	7.8	Ch	4287.9	9.1	Lp
	4252.1	8.3	Ro	4289.1	9.4	Ly
	4254.1	7.8	Ro	4289.2	9.2	Al
	4259.1	8.0	Ro	4295.2	10.0	Mh
	4259.5	8.1	Mm	4296.9	9.8	Lp
	4260.1	8.0	Ro	4297.1	9.4	Pt
	4262.1	9.5	Jo	4298.	10.0	Ro
	4264.1	8.2	Cy	4298.2	9.8	Cy
	4265.1	8.2	Pt	4300.1	9.8	Al
	4266.2	8.3	Sg	4300.1	9 5	Ks
	4268.1	8.8	Al	4301.9	10.0	Lp
	4268.1	8.8	Ly	4305.1	10.1	Cu
	4269.1	8.7	Ly	4305.9	10.2	Lp
	4270.1	8.6	Ly	4309.1	10 0	Al
	4273.1	8.6	Jo	4309.2	10.4	Cy
	4273.1	8.8	Ly	4310.9	10.4	Lp
	4276.1	8.4	L	4313.2	10.5	Cy
	4281.1	9.3	Cy	4315.2	11.0	Jo
	4281.9	9.1	Lp	4316.3	10.9	Mh
	4282.3	9.0	Sg	4318.	9.5	Ro
	4283.1	9.2	Ly	4319.2	10.7	Cy
	4286.1	9.3	Ly	4321.1	10 8	Cu
142584 R CAMELOPARDALIS—						
	4262.3	9.2	Wf	4299.1	8.1	Du
	4267.1	8.6	Gb	4301.9	8.3	Lp
	4268.3	9.2	Wf	4305.1	8.0	Cu
	4269.1	8.8	Du	4307.3	8.0	Wf

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
142584 R CAMELOPARDALIS—Continued.						
	4274.2	8.6	Br	4309.1	8.1	Du
	4278.3	8.5	Wf	4310.1	8.1	Du
	4282.1	8.5	Gb	4312.0	8.2	Lp
	4284.1	8.3	Du	4313.1	8.1	Du
	4285.9	8.7	Lp	4314.1	8.2	Du
	4286.3	8.4	Wf	4315.1	8.2	Du
	4288.3	8.2	Wf	4316.2	8.2	Du
	4289.1	8.2	Du	4317.3	8 2	Du
	4290.1	8.2	Du	4318.1	8.3	Ya
	4291.1	8.2	Du	4318.2	8.0	Gb
	4296.3	8.4	Wf	4319.1	8.3	Du
	4297.2	8.1	Du	4321.1	8 4	Cu
	4298.2	8.2	Du	4321.3	8.2	Du
143227 R BOOTIS—						
	4265.1	12.3	Pt	4299.1	12.0	Ie
	4266.3	11.7	Sg	4307.1	11.5	Cu
	4268.1	12.0	Cy	4316.3	10.0	Mh
	4297.1	12.4	Pt	4318.2	10.0	B
	4298.3	12.2	Cy	4321.1	10.5	Cu
144918 U BOOTIS—						
	4264.2	12.0	Cy	4313.2	10.4	Cy
	4292.2	11.3	Cy	4319.2	9.9	Cy
145254 Y LUPI—						
	4227.4	[13.7	Bl	4258.6	12.6	Bl
	4238.5	14.0	Bl	4265.8	11.9	Sm
	4245.6	13.3	Bl	4268.6	11.2	Bl
	4252.5	13.2	Bl			
145971 S APODIS—						
	4218.5	10.3	Bl	4252.5	10.3	Bl
	4222.5	10.4	Bl	4258.6	10.2	Bl
	4238.5	10.5	Bl	4265.8	10.4	Sm
	4245.6	10.5	Bl	4268.6	10.3	Bl
150519 T LIBRAE—						
	4268.3	12.5	Pt	4297.1	13.7	Pt
150605 Y LIBRAE—						
	4268.3	12.9	Pt	4297.1	[12.0	Pt
	4295.3	13.1	Br	4299.0	13.5	L
151520 S LIBRAE—						
	4255.7	[10.4	Ch	4299.0	9.1	L
	4268.3	9.8	Pt	4318.1	8.6	Ya
	4297.1	8.6	Pt			
151714 S SERPENTIS—						
	4256.3	13.4	Wf	4291.3	12.5	Wf
	4262.3	13.3	Wf	4295.3	12.5	Br
	4267.4	13.2	Br	4297.1	12.6	L
	4268.3	12.8	Wf	4297.3	12.6	Wf
	4283.3	12.3	Wf	4315.2	12.4	Cy
	4285.3	12.7	Wf			
151731 S CORONAE BOREALIS—						
	4256.3	10.6	Wf	4278.3	11.2	Wf
	4262.3	10.6	Wf	4285.3	11.7	Wf
	4263.1	10.5	Mx	4287.3	11.5	Pj
	4266.2	10.3	Mh	4288.3	11.8	Wf
	4266.3	10.8	Sg	4296.3	11.6	Wf
	4267.1	10.9	Gb	4296.2	11.8	Sg
	4267.4	10.9	Br	4297.1	12.0	Sg
	4268.3	10.7	Wf	4307.3	12.1	Wf
	4268.3	10.2	Pt	4315.2	12.2	Sg
	4262.9	10.5	Cy	4319.3	12.4	Cy

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
151822 RS LIBRAE—						
	4225.5	9.9	Bl	4265.8	7.9	Sm
	4238.5	9.0	Bl	4267.8	8.0	Ht
	4245.6	8.6	Bl	4268.6	8.1	Bl
	4246.8	8.6	Ht	4299.0	8.1	L
	4252.5	8.4	Bl	4317.2	9.5	B
	4255.8	8.3	Ht			
152714 RY LIBRAE—						
	4268.3	13.3	Pt	4299.0	13.1	L
	4297.1	13.4	Pt			
152849 R NORMAE—						
	4218.5	8.5	Bl	4252.6	7.9	Bl
	4225.5	8.5	Bl	4265.8	8.2	Sm
	4238.5	8.5	Bl	4268.6	8.0	Bl
	4245.6	8.0	Bl			
153020 X LIBRAE—						
	4227.5	12.5	Bl	4258.6	12.7	Bl
153215 W LIBRAE—						
	4238.5	[13.1	Bl	4268.6	12.1	Bl
	4258.6	12.5	Bl			
153378 S URSAE MINORIS—						
	4252.1	8.9	Ro	4286.3	8.9	Wf
	4254.1	8.7	Ro	4287.2	9.3	Mh
	4259.1	9.0	Ro	4288.3	9.2	Wf
	4260.1	9.0	Ro	4289.1	9.7	Du
	4262.1	8.9	Du	4289.2	9.4	Cy
	4262.3	8.6	Wf	4290.1	9.8	Du
	4263.1	8.8	Du	4291.1	9.8	Du
	4264.1	9.0	Du	4294.2	10.0	Mh
	4266.2	9.0	Du	4296.3	9.8	Wf
	4266.3	8.7	Sg	4297.1	9.2	Pt
	4268.1	9.0	Du	4297.2	9.5	Sg
	4268.3	8.8	Wf	4297.2	9.8	Du
	4268.3	8.5	Pt	4298.	10.6	Ro
	4269.1	8.9	Du	4298.2	9.8	Du
	4269.1	8.5	Al	4307.3	9.9	Wf
	4269.2	8.5	Cy	4308.1	10.0	Cy
	4274.2	9.1	Du	4312.1	10.6	Mh
	4277.1	9.1	Du	4313.1	9.9	Du
	4278.1	9.3	Du	4314.1	10.4	Al
	4278.3	8.9	Wf	4314.2	10.2	Sg
	4279.0	9.4	Du	4315.1	10.0	Du
	4280.1	9.5	Du	4319.1	10.3	Du
	4284.1	9.7	Du			
153620a U LIBRAE—						
	4238.5	[12.9	Bl	4258.6	[12.9	Bl
153654 T NORMAE—						
	4246.8	8.7	Ht	4265.8	9.9	Sm
	4252.8	8.9	Ht	4267.8	10.5	Ht
154020 T LIBRAE—						
	4238.5	[13.0	Bl	4258.6	[12.7	Bl
154428 R CORONAE BOREALIS—						
	4234.0	6.0	Kb	4289.1	6.2	Al
	4240.6	6.1	Kb	4289.1	6.2	Ly
	4245.7	5.8	Ch	4289.1	5.9	Du
	4250.8	6.0	Kd	4289.2	6.2	Pt
	4252.9	6.3	Sh	4290.2	6.2	Pt
	4254.5	6.2	Kd	4290.5	5.5	Mm
	4254.7	6.0	Ch	4291.2	6.2	Pt
	4255.9	6.1	Kb	4291.2	6.3	Mh
	4256.3	6.0	Wf	4291.3	6.1	Wf

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
154428 R CORONAE BOREALIS—Continued.						
	4256.9	6.4	Kl	4291.9	6.2	Sh
	4258.5	6.2	Kd	4292.1	6.1	Cy
	4259.1	5.9	Ro	4292.2	6.1	Pt
	4259.3	5.9	Wf	4292.2	6.1	Jo
	4260.1	5.9	Ro	4292.5	6.0	Kd
	4260.1	6.3	Cy	4293.1	6.1	L
	4260.6	6.0	Ch	4293.2	6.2	Pj
	4260.9	6.3	Kl	4294.2	6.6	Mh
	4261.1	6.1	Pt	4294.3	6.3	Pj
	4261.9	5.9	Kb	4295.2	6.1	Pt
	4261.9	6.2	Sh	4296.2	6.0	Wb
	4262.1	5.8	Ly	4296.2	6.0	Sg
	4262.1	6.0	Jo	4296.3	6.1	Wf
	4262.1	6.0	Du	4296.9	6.1	L
	4262.2	6.0	Sg	4296.9	6.2	Sh
	4262.3	6.1	Pt	4297.1	6.1	Pt
	4262.3	6.1	Cy	4297.1	6.0	Ly
	4262.3	6.0	Wf	4298.	5.8	Ro
	4263.2	6.2	Cy	4298.2	6.1	Cy
	4264.2	6.2	Pt	4298.3	6.0	Wf
	4264.2	6.1	Cy	4298.3	6.0	Wb
	4264.3	6.0	Sg	4299.1	6.1	Ie
	4264.9	6.1	Sh	4299.2	6.2	Pt
	4265.1	6.1	Pt	4300.1	6.2	Al
	4265.1	5.8	Ly	4300.1	6.2	Cu
	4265.8	6.0	Kd	4300.2	6.2	Pt
	4266.0	5.9	Kb	4301.1	6.1	Cy
	4266.1	6.1	Pt	4301.2	6.2	Pt
	4266.2	6.5	Mh	4302.1	6.1	Cu
	4267.0	6.3	Kd	4302.1	6.1	Cm
	4267.1	5.8	Gb	4302.2	6.2	Pt
	4267.6	6.1	Ch	4302.4	6.0	Wf
	4268.1	5.7	Ly	4302.9	6.2	Sh
	4268.1	6.1	Cy	4303.4	6.2	Pt
	4268.1	6.2	Al	4304.2	6.0	Cu
	4268.3	6.0	Wf	4304.3	6.1	Wf
	4268.3	6.1	Pt	4304.4	6.2	Pt
	4269.1	5.8	Ly	4305.1	6.1	Cu
	4269.1	6.0	Du	4305.2	6.2	Pt
	4269.2	5.9	Wf	4306.2	6.1	Pt
	4269.2	6.1	Cy	4307.1	6.0	Cu
	4269.9	6.2	Kl	4307.2	6.0	Cy
	4270.2	5.9	Wf	4308.1	6.0	Cy
	4270.4	6.2	Pt	4308.1	6.1	Cu
	4271.5	6.2	Kd	4309.1	6.1	Cu
	4272.1	6.2	Pt	4309.1	6.2	Ie
	4273.1	5.8	Ly	4309.1	6.2	Ch
	4273.1	6.2	Jo	4309.2	6.2	Pt
	4273.4	6.5	Mh	4309.2	6.0	Cy
	4274.3	6.2	Pt	4310.1	6.3	Mh
	4275.3	6.2	Pt	4311.1	6.0	Ly
	4275.5	6.0	Kd	4311.2	6.2	Pt
	4276.1	5.9	L	4312.2	6.1	Pt
	4276.9	6.1	Kl	4313.1	6.0	Ly
	4277.1	6.0	Du	4313.1	6.1	Ie
	4277.2	6.1	Pt	4313.2	6.2	Pt
	4278.1	6.1	Pt	4313.2	6.1	Cy
	4279.1	6.0	Du	4314.	5.8	Ro
	4279.1	6.0	Cy	4314.1	6.0	Cu
	4279.3	6.0	Wf	4314.2	5.9	Jo

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
154428 R CORONAE BOREALIS—Continued.						
	4280.1	6.0	Du	4314.2	6.2	Pt
	4281.1	6.0	Cy	4315.1	6.2	Cu
	4282.1	6.1	Pt	4315.2	6.0	Jo
	4282.1	6.0	Gb	4315.2	6.1	Cy
	4282.3	6.1	Wf	4315.2	6.2	Pt
	4282.6	6.1	Kd	4315.2	6.0	Sg
	4283.1	6.0	Ks	4316.2	6.2	Pt
	4283.1	6.0	Ly	4316.3	6.3	Mh
	4283.1	6.1	Pt	4317.1	6.0	Cu
	4283.3	6.2	Wf	4317.2	6.2	Pt
	4284.6	6.2	Kd	4318.1	6.2	Pt
	4285.1	6.1	Pt	4318.1	6.0	Ya
	4285.3	6.1	Wf	4318.1	6.0	Ly
	4286.1	6.1	Pt	4318.2	6.2	Gb
	4286.3	6.1	Wf	4319.1	6.0	Cu
	4286.3	6.2	Sg	4319.2	6.1	Cy
	4286.9	6.2	Sh	4320.1	6.2	Pt
	4287.2	6.0	Pt	4321.1	6.0	Cu
	4287.2	6.4	Mh	4322.1	6.0	Jo
	4287.3	6.2	Wf	4322.1	6.1	Cu
	4287.5	6.2	Kd	4323.1	6.1	Cm
	4288.2	6.2	Pt	4326.1	6.0	Cu
	4288.5	6.2	Kd			
154536 X CORONAE—						
	4256.3	13.1	Wf	4285.3	13.5	Wf
	4262.3	13.3	Wf	4291.3	13.5	Wf
	4267.4	13.5	Br	4298.3	13.4	Wf
	4268.3	13.2	Wf	4307.3	13.3	Wf
	4283.3	13.6	Wf	4313.1	13.5	Ie
154615 R SERPENTIS—						
	4205.7	7.4	Kk	4266.6	8.2	Kk
	4206.6	7.3	Kk	4266.7	8.1	Ch
	4207.6	7.3	Kk	4267.4	8.4	Kk
	4212.6	7.4	Kk	4267.4	9.0	Br
	4225.7	7.4	Kk	4268.3	8.4	Pt
	4226.6	7.3	Kk	4271.6	8.4	Kk
	4227.6	7.3	Kk	4275.8	8.6	Kk
	4228.6	7.3	Kk	4281.9	9.8	Lp
	4229.0	7.3	Kk	4282.6	9.1	Kk
	4230.6	7.3	Kk	4287.9	9.9	Lp
	4231.6	7.4	Kk	4296.2	9.0	Sg
	4235.6	7.4	Kk	4296.9	10.1	Lp
	4240.6	7.5	Kk	4297.1	9.4	Pt
	4242.8	7.6	Kk	4305.9	10.3	Lp
	4254.7	7.9	Ch	4310.9	10.7	Lp
	4255.4	8.0	Kk	4312.1	10.2	Mh
	4259.6	8.0	Kk	4315.2	10.3	Sg
	4264.2	8.3	Cy	4315.2	10.5	Cy
	4266.2	8.2	Mh	4317.1	10.3	B
	4266.3	8.1	Sg			
154639 V CORONAE BOREALIS—						
	4256.3	10.0	Wf	4285.3	10.2	Wf
	4263.1	10.5	Mx	4291.3	10.2	Wf
	4262.3	10.3	Wf	4297.1	8.9	Pt
	4268.3	10.1	Wf	4298.3	9.8	Wf
	4268.3	8.8	Pt	4307.3	9.8	Wf
	4280.3	10.0	Wf	4319.3	9.8	Cy
154715 R LIBRAE—						
	4268.2	11.0	Pt	4297.1	12.6	Pt
155018 RR LIBRAE—						
	4255.7	[10.9	Ch	4317.1	10.7	B
	4299.0	11.7	L			
155229 Z CORONAE BOREALIS—						
	4267.4	12.5	Br	4319.2	[13.2	Cy
	4313.1	13.8	Ie			
155823 RZ SCORPII—						
	4246.9	9.0	Ht	4267.8	8.9	Ht
	4255.8	8.6	Ht	4268.2	8.2	Pt
	4265.8	8.4	Sm	4297.1	10.2	Pt
160021 Z SCORPII—						
	4238.6	11.8	Bl	4265.8	[11.2	Sm
	4245.6	11.9	Bl	4268.6	12.0	Bl
	4258.6	12.0	Bl	4299.0	12.3	L
160118 R HERCULIS—						
	4258.2	12.7	Sg	4268.2	13.4	Pt
	4266.7	[10.7	Ch	4315.1	13.8	Ie
	4267.4	13.5	Br			
160210 Y SERPENTIS—						
	4264.2	9.2	Cy	4293.2	10.5	Pj
	4266.3	9.2	Sg	4294.3	10.2	Pj
	4267.4	9.2	Br	4296.2	10.4	Sg
	4268.2	9.0	Pt	4297.1	10.5	Pt
	4283.3	9.5	Pj	4298.2	10.8	Cy
	4284.2	9.8	Pj	4313.2	11.7	Cy
	4285.3	9.5	Pj	4315.1	11.7	Ie
	4287.3	9.9	Pj	4315.2	11.7	Sg
	4289.2	10.2	Cy	4319.2	11.8	Cy
	4292.2	9.8	Cy			
160221a X SCORPII—						
	4238.6	[13.0	Bl	4268.6	12.4	Bl
	4258.6	12.8	Bl			
160325 SX HERCULIS—						
	4247.3	7.9	Wf	4288.3	9.1	Wf
	4248.2	7.7	Wf	4289.2	8.6	Pt
	4256.3	7.9	Wf	4291.3	9.2	Wf
	4261.1	8.0	Pt	4292.2	8.6	Pt
	4262.3	8.0	Wf	4295.2	8.8	Pt
	4264.2	8.0	Pt	4297.0	8.7	L
	4265.1	8.0	Pt	4297.1	8.7	Pt
	4266.1	8.0	Pt	4298.3	8.9	Wf
	4268.3	8.0	Pt	4300.2	8.8	Pt
	4268.3	8.1	Wf	4301.2	8.8	Pt
	4270.4	8.1	Pt	4302.4	8.8	Pt
	4272.1	8.0	Pt	4303.4	9.0	Pt
	4274.3	8.4	Pt	4304.4	9.0	Pt
	4275.3	8.4	Pt	4305.2	8.8	Pt
	4276.1	8.2	L	4306.2	9.3	Pt
	4278.1	8.4	Pt	4309.2	8.7	Pt
	4280.3	8.7	Wf	4311.2	8.3	Pt
	4282.3	8.9	Wf	4312.2	8.4	Pt
	4283.1	8.6	Pt	4314.2	8.3	Pt
	4285.1	8.4	Pt	4315.2	8.5	Pt
	4285.3	8.8	Wf	4316.2	8.5	Pt
	4286.1	8.6	Pt	4317.2	8.6	Pt
	4286.3	9.1	Wf	4318.1	8.4	Pt
	4288.2	8.6	Pt	4320.1	8.4	Pt
160519 W SCORPII—						
	4238.1	[13.0	Bl	4258.6	[12.5	Bl

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
160625 RU HERCULIS—						
	4256.3	14.1	Wf	4288.3	14.0	Wf
	4262.3	14.2	Wf	4291.3	13.8	Wf
	4267.4	14.2	Br	4297.1	14.1	L
	4268.3	14.1	Wf	4298.3	13.8	Wf
	4282.2	14.0	Wf	4315.1	13.0	Ie
	4285.3	14.0	Wf			
161122a R SCORPII—						
	4238.6	[12.6	Bl	4265.8	[12.2	Sm
	4258.6	[13.0	Bl	4297.2	12.6	Pt
161122b S SCORPII—						
	4238.6	12.2	Bl	4258.6	12.8	Bl
	4245.6	12.2	Bl	4265.8	[12.2	Sm
161138 W CORONAE BOREALIS—						
	4256.3	12.6	Wf	4285.3	13.4	Wf
	4262.3	12.9	Wf	4288.3	13.4	Wf
	4267.3	13.0	Pt	4296.3	13.4	Wf
	4268.3	13.0	Wf	4302.3	13.4	Wf
	4282.2	13.1	Wf	4315.1	13.0	Ie
161607 W OPHIUCHI—						
	4299.0	14.4	L			
162112 V OPHIUCHI—						
	4267.3	8.6	Pt	4307.2	10.1	Cu
	4297.2	9.2	Pt	4321.1	10.3	Cu
162119 U HERCULIS—						
	4256.3	10.9	Wf	4283.9	8.3	Kl
	4256.9	11.0	Kl	4284.5	9.0	Kk
	4258.0	11.0	Kl	4285.3	8.6	Wf
	4260.9	10.5	Kl	4288.3	8.5	Wf
	4262.3	10.3	Wf	4288.5	8.8	Kk
	4262.9	10.2	Kl	4289.2	7.8	Jo
	4265.2	9.5	Jo	4290.5	8.7	Kk
	4266.3	9.4	Sg	4291.2	8.8	Mh
	4266.8	9.8	Ch	4292.6	8.7	Kk
	4267.0	10.1	Kl	4294.2	8.8	Mh
	4267.3	9.8	Pt	4296.2	8.6	Sg
	4267.4	9.5	Br	4296.3	8.4	Wf
	4268.1	9.4	Jo	4297.2	7.8	Pt
	4268.3	9.6	Wf	4302.1	8.1	Cu
	4269.9	10.0	Kl	4302.3	7.8	Wf
	4271.0	9.7	Kl	4309.1	7.7	Ie
	4271.6	9.4	Kk	4312.1	8.4	Mh
	4271.6	9.4	Kk	4314.2	7.7	Jo
	4275.8	9.1	Kk	4315.2	8.5	Sg
	4276.9	9.3	Kl	4316.3	8.4	Mh
	4278.3	8.8	Wf	4319.2	7.5	Jo
	4282.5	8.9	Kk	4321.1	7.9	Jo
	4283.6	8.8	Kk	4323.1	8.3	Cu
162807 SS HERCULIS—						
	4264.2	10.0	Cy	4283.6	9.7	Kk
	4267.3	10.0	Pt	4288.6	9.4	Kk
	4271.7	9.9	Kk	4290.6	9.4	Kk
	4271.7	9.9	Kk	4292.6	9.3	Kk
	4276.1	9.3	L	4297.2	9.0	Pt
162815 T OPHIUCHI—						
	4232.8	9.6	Bl	4268.6	10.0	Bl
	4245.6	9.2	Bl	4297.0	11.1	L
	4258.6	9.5	Bl	4297.2	11.0	Pt
	4267.3	10.3	Pt	4317.1	11.9	B
162816 S OPHIUCHI—						
	4232.8	[13.1	Bl	4276.1	9.8	L
	4258.7	10.5	Bl	4317.1	10.8	B
	4268.6	9.9	Bl			
163137 W HERCULIS—						
	4266.8	11.2	Ch	4297.2	8.4	Pt
	4283.1	9.5	Pt	4315.1	8.2	Ie
	4295.4	8.5	Br			
163172 R URSAE MINORIS—						
	4285.9	9.5	Lp	4312.0	9.6	Lp
	4305.9	9.6	Lp			
163266 R DRACONIS—						
	4261.9	[10.6	Ch	4302.0	10.8	Lp
	4283.1	11.4	Pt	4307.2	10.9	Cu
	4285.9	11.3	Lp	4311.0	10.8	Lp
	4295.4	11.5	Br	4321.1	10.7	Cu
	4297.2	11.3	Pt			
164319 RR OPHIUCHI—						
	4267.8	[12.0	Sm	4297.2	13.3	Pt
	4285.2	13.1	Pt	4299.1	[13.0	L
164715 S HERCULIS—						
	4269.2	8.8	Jo	4309.1	7.6	Ie
	4285.2	8.3	Pt	4314.2	8.1	Jo
	4297.2	8.1	Pt			
164841 RS SCORPII—						
	4225.5	6.3	Bl	4258.7	6.5	Bl
	4238.5	6.1	Bl	4265.8	6.5	Sm
	4245.6	6.8	Bl	4267.8	7.7	Ht
	4246.8	6.9	Ht	4268.6	7.0	Bl
	4255.8	6.9	Ht			
165030 RR SCORPII—						
	4232.8	6.1	Bl	4258.7	7.0	Bl
	4245.6	6.5	Bl			
165202 SS OPHIUCHI—						
	4285.2	12.2	Pt	4297.2	12.1	Pt
165631 RV HERCULIS—						
	4283.1	13.5	Pt	4299.1	[13.4	Ie
	4286.2	13.7	Bi	4300.3	13.9	Bi
165636 RT SCORPII—						
	4232.8	[13.0	Bl	4258.7	[13.0	Bl
170215 R OPHIUCHI—						
	4261.9	8.9	Ch	4311.2	8.0	Ly
	4269.2	8.6	Jo	4312.1	8.3	Mh
	4269.2	8.4	Cy	4313.2	8.1	Ly
	4283.1	7.8	Pt	4314.1	8.1	Jo
	4289.2	7.5	Jo	4314.1	8.6	Al
	4291.2	8.0	Mh	4315.2	8.0	Jo
	4295.2	8.3	Mh	4316.3	8.4	Mh
	4297.2	7.6	Pt	4321.1	8.2	Jo
	4298.2	8.2	Cy	4323.2	8.3	Cm
170627 RT HERCULIS—						
	4256.3	10.1	Wf	4280.3	10.8	Wf
	4262.3	10.2	Wf	4283.1	11.2	Pt
	4267.4	10.5	Br	4297.2	11.3	Pt
	4268.3	10.6	Wf			
170833 RW SCORPII—						
	4232.8	[12.6	Bl	4258.7	[12.5	Bl
171401 Z OPHIUCHI—						
	4283.1	10.8	Pt	4315.2	11.8	Cy
	4297.2	11.2	Pt			

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
171723 RS HERCULIS—						
	4256.3	8.6	Wf	4285.3	8.5	Wf
	4262.3	8.3	Wf	4291.4	8.5	Wf
	4268.3	8.3	Wf	4297.2	8.3	Pt
	4280.3	8.5	Wf	4298.3	8.6	Wf
	4283.1	8.2	Pt			
172486 S OCTANTIS—						
	4218.5	10.4	Bl	4246.9	12.1	Ht
	4225.5	10.9	Bl	4258.7	12.5	Bl
	4238.5	11.4	Bl	4267.8	12.8	Ht
	4245.6	11.9	Bl			
172809 RU OPHIUCHI—						
	4283.1	9.9	Pt	4297.2	12.0	Pt
173543 RU SCORPII—						
	4232.8	13.3	Bl	4258.7	13.0	Bl
174135 SV SCORPII—						
	4232.7	9.7	Bl	4258.7	9.9	Bl
	4245.6	9.8	Bl			
174162 W PAVONIS—						
	4218.5	9.7	Bl	4252.5	9.4	Bl
	4225.5	9.1	Bl	4255.9	9.4	Ht
	4232.8	9.2	Bl	4267.8	9.9	Ht
	4245.6	9.1	Bl	4268.6	9.7	Bl
	4246.9	9.1	Ht			
174406 RS OPHIUCHI—						
	4283.1	11.2	Pt	4297.2	11.1	Pt
174551 U ARAE—						
	4265.8	11.1	Sm			
175111 RT OPHIUCHI—						
	4283.1	11.7	Pt	4317.2	10.2	B
	4297.2	11.0	Pt			
175519 RY HERCULIS—						
	4266.8	[11.7	Ch	4297.2	13.6	Pt
	4283.1	13.5	Pt	4300.7	13.7	Bi
	4286.2	14.0	Bi	4318.2	13.8	Bi
180363 R PAVONIS—						
	4246.9	12.0	Ht	4265.8	10.5	Sm
	4255.9	11.0	Ht	4267.9	10.1	Ht
180531 T HERCULIS—						
	4264.3	[11.0	Sg	4297.2	12.6	Pt
	4256.3	12.9	Wf	4300.1	12.4	Cu
	4262.3	12.9	Wf	4301.9	11.8	Lp
	4266.8	[11.0	Ch	4302.3	11.5	Wf
	4268.3	13.5	Wf	4305.9	11.2	Lp
	4280.3	13.4	Wf	4310.9	10.4	Lp
	4283.1	13.0	Pt	4312.2	10.3	Mh
	4284.1	[11.0	Mx	4313.2	10.6	Ie
	4285.3	13.4	Wf	4313.2	9.8	Ly
	4285.9	[12.0	Lp	4314.1	10.8	Mx
	4288.3	13.4	Wf	4314.1	10.7	Cu
	4296.3	12.3	Wf	4315.3	9.6	Sg
	4296.9	12.3	Lp	4318.2	9.8	Ly
180565 W DRACONIS—						
	4269.2	9.7	Du	4299.1	9.8	Du
	4283.1	9.3	Pt	4300.4	9.9	Bi
	4284.2	9.7	Du	4313.1	9.9	Du
	4286.3	9.6	Bi	4314.1	10.0	Du
	4289.2	9.6	Du	4315.1	10.1	Du
	4290.1	9.6	Du	4318.3	10.0	Bi
	4291.1	9.7	Du	4316.1	10.0	Du
180565 W DRACONIS—Continued.						
	4297.2	9.1	Pt	4319.1	10.4	Du
	4297.2	9.8	Du			
180666 X DRACONIS—						
	4286.3	13.9	Bi	4318.3	13.8	Bi
	4300.4	14.0	Bi			
180911 NOVA OPHIUCHI—						
	4283.1	13.6	Pt	4297.2	[13.0	Pt
181031 TV HERCULIS—						
	4276.1	9.7	L			
181103 RY OPHIUCHI—						
	4256.4	12.1	Wf	4288.3	8.5	Wf
	4262.3	11.6	Wf	4296.3	8.3	Wf
	4268.3	11.0	Wf	4297.2	8.4	Pt
	4278.3	9.4	Wf	4300.3	8.6	Bi
	4283.1	8.9	Pt	4302.3	8.6	Wf
	4285.3	8.7	Wf	4318.2	9.2	Bi
	4286.2	8.9	Bi			
181136 W LYRAE—						
	4212.7	8.4	Kk	4268.3	9.4	Wf
	4215.8	8.4	Kk	4269.2	8.8	Jo
	4225.6	8.5	Kk	4271.6	9.6	Kk
	4226.7	8.5	Kk	4273.2	8.9	Jo
	4227.6	8.3	Kk	4278.3	9.8	Wf
	4228.6	8.3	Kk	4282.2	10.1	Wf
	4230.6	8.1	Kk	4283.1	10.6	Pt
	4231.6	8.2	Kk	4285.3	10.7	Wf
	4235.6	8.4	Kk	4288.3	11.2	Wf
	4240.6	8.3	Kk	4289.2	9.5	Jo
	4242.8	8.7	Kk	4292.9	11.1	L
	4256.3	8.9	Wf	4296.3	12.0	Wf
	4256.6	9.3	Kk	4297.2	11.7	Pt
	4257.6	9.3	Kk	4300.2	[12.5	Al
	4258.7	9.3	Kk	4302.3	12.2	Wf
	4259.6	9.3	Kk	4304.3	12.0	Wf
	4262.3	8.9	Wf	4306.3	12.2	Wf
	4263.6	9.3	Wf	4315.1	12.6	Cu
	4264.3	9.0	Sg	4317.1	12.2	B
	4267.5	9.5	Kk			
182133 RV SAGITTARII—						
	4232.7	8.4	Bl	4258.7	9.9	Bl
	4245.6	8.5	Bl			
182224 SV HERCULIS—						
	4317.2	13.7	B			
183308 X OPHIUCHI—						
	4258.7	9.2	Kk	4297.2	8.5	Pt
	4263.6	9.1	Kk	4302.9	8.5	Sh
	4267.6	9.1	Kk	4307.2	8.7	Cy
	4269.2	8.8	Cy	4307.3	8.5	Wb
	4271.6	8.8	Kk	4308.2	8.6	Cu
	4271.6	8.8	Kk	4313.2	8.7	Cy
	4275.8	8.9	Kk	4316.2	8.0	Jo
	4283.1	8.4	Pt	4316.3	8.7	Wb
	4290.1	8.6	L	4319.1	8.6	Jo
	4290.6	9.2	Kk	4319.2	8.6	Cy
	4292.2	8.7	Cy	4321.2	8.6	Cu
	4292.6	8.2	Kk			
184134 RY LYRAE—						
	4295.4	[13.3	Br			

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
184205 R SCUTI—				
	4215.8	5.6 Kk	4301.4	7.0 Pt
	4228.8	5.8 Kk	4302.4	7.0 Pt
	4229.8	5.7 Kk	4303.4	7.0 Pt
	4230.8	5.6 Kk	4304.4	6.9 Pt
	4231.8	5.8 Kk	4305.2	7.0 Pt
	4235.8	5.8 Kk	4307.2	7.0 Cy
	4250.8	5.2 Kd	4307.2	7.0 Cu
	4256.9	5.3 Ch	4308.1	7.0 Cu
	4257.8	5.2 Kb	4309.1	6.8 Cu
	4259.9	5.2 Ch	4309.2	6.9 Cy
	4260.7	5.2 Kb	4311.2	6.5 Pt
	4262.3	5.5 Cy	4312.1	6.5 Cu
	4264.2	5.0 Pt	4312.2	5.8 Mh
	4264.3	5.5 Gb	4312.2	6.3 Pt
	4265.8	5.2 Kb	4313.1	6.7 Ie
	4266.8	5.3 Ch	4313.2	6.0 Pt
	4267.3	5.2 Pt	4314.1	6.3 Cu
	4268.3	5.4 Pt	4314.2	5.9 Pt
	4269.2	5.3 Cy	4314.2	6.4 Cy
	4270.4	5.5 Pt	4314.2	5.8 Jo
	4271.6	4.9 Kd	4314.3	5.5 Sg
	4272.8	5.3 Kd	4315.1	6.4 Cu
	4273.3	5.3 Pt	4315.2	6.0 Jo
	4274.3	5.4 Pt	4315.2	6.1 Pt
	4275.3	5.4 Pt	4315.2	5.8 Cy
	4276.1	5.2 L	4315.2	6.6 Ie
	4284.6	5.3 Kd	4316.	5.8 Ro
	4285.2	6.0 Pt	4316.2	6.0 Pt
	4288.2	6.1 Pt	4316.3	5.7 Mh
	4289.2	6.1 Pt	4317.1	5.8 Cu
	4289.6	5.9 Kd	4317.2	5.8 Pt
	4290.1	6.3 L	4318.	6.0 Ro
	4290.2	6.0 Gb	4318.1	5.9 Pt
	4292.2	5.2 Ch	4318.2	6.0 Gb
	4292.5	5.9 Kd	4319.1	6.0 Cu
	4293.1	6.0 L	4319.2	5.5 Cy
	4293.4	6.4 Cy	4320.2	5.9 Pt
	4295.2	6.1 Pt	4321.1	5.4 Cu
	4295.6	6.1 Kd	4321.1	5.4 Jo
	4297.0	6.5 L	4321.2	5.6 Ks
	4297.2	6.5 Pt	4322 1	5.1 Cu
	4297.2	6.5 Gb	4326.1	5.1 Cu
	4298.3	7.0 Cy		
	4301.2	6.8 Gb		
184300 NOVA AQUILAE—				
	4264.2	11.0 Pt	4311.2	11.0 Pt
	4265.2	10.8 Pt	4313.1	10.6 Ie
	4268.3	10.9 Pt	4314.	10.9 Ro
	4288.2	10.7 Pt	4315.2	10.8 Pt
	4295.2	10.8 Pt	4316.	10.9 Ro
	4297.2	11.0 Pt	4318.	10.9 Ro
	4303.4	10.5 Pt	4320.2	11.0 Pt
185032 RX LYRAE—				
	4285.2	14.6 Pt	4295.4	15.0 Br
185437a S CORONAE AUSTRALIS—				
	4232.7	11.5 Bl	4258.7	11.4 Bl
	4245.6	11.4 Bl	4268 6	11.5 Bl

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
185512a ST SAGITTARII—				
	4247.7	10.2 Ch	4314.2	11.8 Cu
	4259.9	9.0 Ch	4319.2	11.9 Cu
	4293.1	10.5 L		
185537a R CORONAE AUSTRALIS—				
	4232.7	12.4 Bl	4268.6	11.7 Bl
	4245.6	11.5 Bl	4269.5	11.9 Bl
	4258.7	12.5 Bl		
185537b T CORONAE AUSTRALIS—				
	4232.7	[13.0 Bl	4258.7	[12.5 Bl
185634 T LYRAE—				
	4285.2	[12.9 Pt	4295.4	14.2 Br
185737 RT LYRAE—				
	4266.8	11.4 Ch		
190108 R AQUILAE—				
	4261.9	8.4 Ch	4308.2	10.7 Cu
	4285.2	8.7 Pt	4311.2	10.0 Pt
	4297.0	9.5 Lp	4311.9	10.7 Lp
	4306.0	10.1 Lp	4321.2	10.9 Cu
190529a V LYRAE—				
	4285.2	9.0 Pt	4311.2	9.0 Pt
	4295.4	9.5 Br		
190818 RX SAGITTARII—				
	4247.9	[10.8 Ch	4319.2	[12.4 Cu
	4315 2	[12.2 Cu		
190819a RW SAGITTARII—				
	4247.9	10.3 Ch	4315.2	10.1 Pt
	4258.9	10.4 Ch	4315.2	10.3 Cu
	4285.2	10.7 Pt		
190907 TY AQUILAE—				
	4285.2	10.3 Pt	4315.2	10.2 Pt
190925 S LYRAE—				
	4295.4	[13.1 Br	4300.3	[14.0 Bi
190926 X LYRAE—				
	4285.2	9.0 Pt	4315.2	9.0 Pt
190933a RS LYRAE—				
	4266.8	10.8 Ch	4300.3	11.4 Bi
	4285.2	10.9 Pt	4315.2	12.4 Pt
	4286.2	10.8 Bi	4318.2	13.0 Bi
190967a U DRACONIS—				
	4285.2	12.2 Pt	4316.1	10.3 Du
	4311.2	11.2 Pt	4319.1	10.5 Du
191007 W AQUILAE—				
	4259.9	[11.8 Ch	4315.2	10.3 Pt
	4285.2	11.4 Pt		
191017 T SAGITTARII—				
	4259.9	10.8 Ch	4315.2	9.2 Pt
	4285.2	9.9 Pt		
191019 R SAGITTARII—				
	4246.0	8.6 Ch	4275.8	7.9 Kk
	4247.9	8.5 Ch	4283.6	7.7 Kk
	4253.9	8.4 Ch	4285.2	6.9 Pt
	4258.9	8.0 Ch	4288.6	7.6 Kk
	4259.9	7.9 Ch	4292.7	7.5 Kk
	4271.8	7.7 Kk	4315.2	7.2 Pt
191033 RY SAGITTARII—				
	4232.7	7.4 Bl	4285 2	7.4 Pt
	4245.6	7.3 Bl	4293.1	7.3 L
	4246.0	7.2 Ch	4299.1	7.6 L
	4258.7	7.4 Bl	4301.4	7.7 Pt
	4259.9	7.5 Ch	4302.4	7.8 Pt

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Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
191033 RY SAGITTARII—Continued.						
	4268.6	7.4	Bl	4303.4	7.7	Pt
	4270.4	7.6	Pt	4304.4	7.8	Pt
	4273.3	7.0	Pt	4315.2	6.8	Pt
	4276.1	7.0	L			
191124 TY SAGITTARII—						
	4232.7	[12.4	Bl	4258.7	[12.4	Bl
191319 S SAGITTARII—						
	4232.7	[12.9	Bl	4285.2	11.1	Pt
	4238.7	[12.9	Bl	4315.2	9.6	Pt
191331 SW SAGITTARII—						
	4232.7	11.9	Bl	4258.7	12.9	Bl
191350 TZ CYGNI—						
	4285.2	10.1	Pt	4315.2	9.9	Pt
191637 U LYRAE—						
	4285.2	8.7	Pt	4311.2	9.0	Pt
191717 T SAGITTAE—						
	4302.9	9.4	Sh			
192928 TY CYGNI—						
	4261.9	[11.2	Ch			
193311 RT AQUILAE—						
	4247.9	7.8	Ch	4311.2	9.6	Pt
	4285.2	8.4	Pt	4322.1	10.6	Cu
	4309.2	9.8	Cu			
193449 R CYGNI—						
	4262.3	13.2	Wf	4296.3	13.4	Wf
	4263.3	[13.0	Wb	4300.3	13.9	Bi
	4267.3	[12.0	Wb	4302.3	13.5	Wf
	4268.4	13.2	Wf	4302.4	13.6	Pt
	4270.4	13.2	Pt	4314.2	[13.1	Cu
	4282.2	13.5	Wf	4318.2	14.0	Bi
	4285.3	13.4	Wf	4321.2	[13.1	Ks
	4286.2	[13.6	Bi	4326.1	[13.1	Cu
	4288.4	13.4	Wf			
193509 RV AQUILAE—						
	4270.4	10.0	Pt	4302.4	10.6	Pt
193972 T PAVONIS—						
	4225.5	11.8	Bl	4258.7	7.9	Bl
	4232.7	11.6	Bl	4265.8	8.6	Sm
	4245.6	10.0	Bl	4267.9	8.9	Ht
	4247.0	10.5	Ht			
194048 RT CYGNI—						
	4256.9	7.3	Ch	4299.1	9.8	Du
	4264.3	7.3	Gb	4300.3	9.7	Bi
	4270.4	8.0	Pt	4302.4	9.8	Pt
	4286.2	9.0	Bi	4307.2	10.6	Cy
	4289.2	9.1	Du	4309.2	10.7	Cu
	4289.2	9.0	Cy	4314.1	11.0	Cu
	4290.2	9.3	Gb	4315.1	[10.4	Du
	4296.2	9.4	Sg	4318.2	10.8	Bi
	4297.2	9.2	Gb	4326.1	11.7	Cu
	4298.2	9.8	Du			
194348 TU CYGNI—						
	4256.9	[10.9	Ch	4314.2	11.8	Cu
	4286.2	[13.0	Bi	4318.2	11.1	Bi
	4300.3	12.7	Bi	4326.1	10.9	Cu
	4302.4	12.5	Pt			
194604 X AQUILAE—						
	4264.4	13.2	Wf	4288.3	13.9	Wf
	4268.4	13.5	Wf	4300.4	13.7	Bi
	4270.4	12.9	Pt	4302.3	14.2	Wf
	4285.3	14.0	Wf			
194632 χ CYGNI—						
	4245.9	9.4	Ch	4285.9	10.9	Lp
	4247.9	9.5	Ch	4288.4	11.0	Wf
	4256.9	9.9	Ch	4297.0	11.1	Lp
	4259.9	10.4	Ch	4302.3	11.4	Wf
	4262.3	10.2	Wf	4302.4	11.3	Pt
	4266.8	10.6	Ch	4311.9	11.7	Lp
	4268.4	10.0	Wf	4314.2	11.8	Cu
	4270.4	10.2	Pt	4326.1	12.0	Cu
	4285.3	10.8	Wf			
194929 RR SAGITTARII—						
	4232.7	12.6	Bl	4258.7	[13.2	Bl
195142 RU SAGITTARII—						
	4232.7	10.3	Bl	4258.7	11.8	Bl
	4245.6	10.9	Bl	4267.9	11.6	Ht
	4247.0	11.3	Ht			
195202 RR AQUILAE—						
	4302.4	10.6	Pt			
195553 NOVA CYGNI—						
	4264.2	12.4	Pt	4290.2	12.5	Pt
	4266.3	12.3	Pt	4297.2	12.5	Pt
	4270.4	12.4	Pt	4302.4	12.5	Pt
	4275.3	12.3	Pt	4311.2	12.5	Pt
	4283.1	12.5	Pt	4315.2	12.6	Pt
	4285.2	12.5	Pt	4320.2	12.6	Pt
	4288.2	12.4	Pt			
195849 Z CYGNI—						
	4261.9	10.0	Ch	4291.3	9.5	Wf
	4262.3	9.3	Wf	4298.3	9.6	Wf
	4268.4	9.4	Wf	4302.3	10.0	Wf
	4270.4	9.0	Pt	4302.4	10.0	Pt
	4280.3	9.1	Wf	4309.2	10.5	Cu
	4285.3	9.5	Wf	4322.1	11.2	Cu
195855 S TELESCOPII—						
	4232.7	13.0	Bl	4258.7	13.0	Bl
200212 SY AQUILAE—						
	4270.4	11.9	Pt	4302.4	12.6	Pt
200357 S CYGNI—						
	4256.3	[15.0	Wf	4291.4	[15.1	Wf
	4262.3	[15.0	Wf	4295.4	[13.0	Br
	4262.8	[15.0	Wf	4296.4	[15.0	Wf
	4285.3	[15.0	Wf	4300.3	[14.0	Bi
	4288.4	[15.0	Wf	4318.2	[14.0	Bi
200514 R CAPRICORNI—						
	4270.4	11.8	Pt	4302.4	12.0	Pt
200715a S AQUILAE—						
	4264.4	11.1	Wf	4296.4	11.6	Wf
	4268.4	11.2	Wf	4302.4	11.3	Wf
	4270.4	11.0	Pt	4302.4	11.0	Pt
	4281.4	11.0	Wf	4306.0	10.8	Lp
	4285.3	11.7	Wf	4311.9	10.6	Lp
	4288.4	11.6	Wf			
200715b RW AQUILAE—						
	4270.4	9.0	Pt	4302.4	9.3	Pt

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
200747 R TELESCOPII—						
	4232.7	9.6	Bl	4258.7	10.4	Bl
	4245.6	10.1	Bl			
200812 RU AQUILAE—						
	4300.4	9.5	Bi			
200822 W CAPRICORNI—						
	4232.7	[12.8	Bl	4302.4	11.7	Pt
	4258.7	[12.8	Bl			
200906 Z AQUILAE—						
	4270.4	13.0	Pt	4302.4	11.0	Pt
200938 RS CYGNI—						
	4245.9	7.8	Ch	4290.6	8.3	Kk
	4247.9	7.8	Ch	4292.2	7.5	Cy
	4256.9	7.4	Ch	4292.6	8.1	Kk
	4259.9	7.2	Ch	4298 2	7.2	Cy
	4261.9	7.2	Ch	4300.6	8.1	Kk
	4263.2	7.5	Cy	4302.4	7.3	Pt
	4264.3	7.0	Gb	4302.9	7.8	Sh
	4266.8	7.3	Ch	4302.9	7.8	Sh
	4269.2	7.4	Cy	4307.2	7.2	Cy
	4270.4	7.4	Pt	4313.2	7.4	Cy
	4271.6	8.1	Kk	4313.3	7.8	Sg
	4275.8	8.1	Kk	4314.2	7.2	Jo
	4276.1	7.5	L	4316.2	7.1	Du
	4283.6	8.0	Kk	4319.1	7.1	Du
	4286.3	7.0	Gb	4319.2	7.1	Du
	4288.6	8.1	Kk			
201008 R DELPHINI—						
	4270.4	13.5	Pt	4314.2	12.5	Cu
	4302.4	13.2	Pt			
201121 RT CAPRICORNI—						
	4260.8	7.4	Kd	4315.2	8.1	Cu
	4302.4	7.3	Pt			
201130 SX CYGNI—						
	4298 3	13.4	Cy			
201139 RT SAGITTARII—						
	4232.7	[13.0	Bl	4258.8	12.5	Bl
201437b WX CYGNI—						
	4263.2	12.3	Cy	4300.3	11.6	Bi
	4269.2	12.3	Cy	4302.4	12.1	Pt
	4273.3	12.8	Pt	4309.2	12.2	Cy
	4286.2	12 5	Bi	4315.3	12.2	Cy
	4292.2	13.0	Cy	4318.2	11.3	Bi
	4298.2	12.3	Cy			
201647 U CYGNI—						
	4246.9	9.9	Ch	4314.2	10.7	Cu
	4269.2	9.4	Jo	4315.3	9.9	Ro
	4273.3	9.0	Pt	4316.	11.0	Ro
	4286.2	9.6	Bi	4318.2	9.1	Bi
	4289.2	9.6	Jo	4318.	11.2	Ro
	4296.3	10.4	Ro	4319.1	10.8	Jo
	4300.3	9.8	Bi	4326.1	10 7	Cu
	4314.2	10.3	Jo			
202240 U MICROSCOPII—						
	4232.7	12.6	Bl	4258.8	13.8	Bl
202817 Z DELPHINI—						
	4300.4	11.4	Bi	4302.4	11.4	Pt
202946 SZ CYGNI—						
	4264.2	9.4	Pt	4301.2	9.2	Pt
	4267 3	9.4	Pt	4302.4	9.2	Pt
	4268.3	8.8	Pt	4303.4	9.0	Pt
202946 SZ CYGNI—Continued.						
	4270.4	8.9	Pt	4304.4	9.1	Pt
	4273.3	8.9	Pt	4305.2	9.2	Pt
	4274.3	9.4	Pt	4306.2	9.5	Pt
	4275.3	9.3	Pt	4309.2	9.5	Pt
	4283.1	8.9	Pt	4311.2	9.5	Pt
	4285.2	8.9	Pt	4312.2	9.3	Pt
	4286.1	9.4	Pt	4313.2	9.3	Pt
	4288.2	8.3	Pt	4314.2	9.2	Pt
	4289.2	9.4	Pt	4315.2	9.2	Pt
	4290.2	9.5	Pt	4316.2	9.3	Pt
	4292.2	9.6	Pt	4317.1	9.3	Pt
	4295.2	9.2	Pt	4318.1	9.3	Pt
	4297.2	9.0	Pt	4320.4	9.4	Pt
	4300.2	9.3	Pt			
202954 ST CYGNI—						
	4273.3	13.1	Pt	4314.2	[12.6	Cu
	4286.2	13.0	Bi	4318.3	13.6	Bi
	4300.3	13.4	Bi	4326.1	[12.6	Cu
	4302.4	13.5	Pt			
203226 V VULPECULAE—						
	4273.3	9.1	Pt	4302.4	8.8	Pt
203429 R MICROSCOPII—						
	4232.7	13.0	Bl	4258.8	[12.8	Bl
203816 S DELPHINI—						
	4273.3	9.7	Pt	4302.4	11.5	Pt
203847 V CYGNI—						
	4245.9	8.7	Ch	4288.4	9.3	Wf
	4256.9	8.0	Ch	4296.4	9.4	Wf
	4262.3	8.4	Wf	4298.2	9.7	Du
	4268.4	8.4	Wf	4300.3	8.5	Bi
	4273.3	8.1	Pt	4302.3	9.6	Wf
	4278.3	8.6	Wf	4302.4	8.3	Pt
	4285.3	8.9	Wf	4318.2	9.0	Bi
	4286.2	8.7	Bi	4319.2	9.8	Du
204016 T DELPHINI—						
	4264.4	14.8	Wf	4298.3	[13.3	Cy
	4269.4	14.7	Wf	4302.3	14.4	Wf
	4273.3	14.9	Pt	4302.4	13.4	Pt
	4285.4	14.7	Wf	4319.3	[13.3	Cy
	4291.4	14.5	Wf			
204012 V AQUARII—						
	4273.3	8.2	Pt	4317.2	9.5	Cu
	4302 4	8.5	Pt			
204215 U CAPRICORNI—						
	4232.8	[12.2	Bl	4258.8	[12.2	Bl
204405 T AQUARII—						
	4253.9	[10.2	Ch	4302.4	13.4	Pt
	4273.3	13.4	Pt			
204846 RZ CYGNI—						
	4262.3	12.1	Wf	4300.3	11.2	Bi
	4269.4	12.1	Wf	4302.3	11.1	Wf
	4273.3	12.5	Pt	4302.4	11.5	Pt
	4285.4	12.0	Wf	4313.4	11.6	Ro
	4286.2	11.3	Bi	4318.2	10.6	Bi
	4291.4	11.7	Wf			
204954 S INDI—						
	4232.7	7.8	Bl	4258.8	9.3	Bl
	4245.8	8.6	Bl			

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
205017 X DELPHINI—				
	4273.3	13.4 Pt	4302.4	13.4 Pt
	4300.4	13.4 Bi	4317.2	12.6 Cu
205923 R VULPECULAE—				
	4264.1	8.8 Wf	4296.4	8.6 Wf
	4268.4	8.8 Wf	4297.3	8.6 Wf
	4273.3	8.5 Pt	4300.4	8.5 Bi
	4281.4	8.6 Wf	4302.3	8.7 Wf
	4282.5	8.2 Wf	4302.4	8.6 Pt
	4285.4	8.8 Wf	4304.3	8.6 Wf
	4286.5	8.7 Wf	4306.3	8.8 Wf
	4287.3	8.7 Wf	4307.3	8.6 Wf
	4288.4	8.6 Wf	4317.2	9.4 Cu
	4291.4	8.7 Wf		
210124 V CAPRICORNI—				
	4232.8	[12.7 Bl	4258.8	[12.5 Bl
210221 X CAPRICORNI—				
	4232.8	[12.7 Bl	4258.8	[12.7 Bl
210504 RS AQUARII—				
	4273.3	13.5 Pt	4302.4	11.9 Pt
210516 Z CAPRICORNI—				
	4302.4	13.4 Pt		
210812 R EQUULEI—				
	4264.4	12.9 Wf	4285.4	13.8 Wf
	4269.4	13.2 Wf	4291.4	14.0 Wf
	4273.3	13.2 Pt	4302.3	14.1 Wf
210868 T CEPHEI—				
	4228.8	8.3 Kk	4279.0	6.9 Du
	4229.0	8.3 Kb	4280.1	6.9 Du
	4229.8	8.2 Kk	4281.1	6.9 Du
	4230.8	8.3 Kk	4282.6	6.5 Kk
	4231.8	8.2 Kk	4283.6	6.8 Kk
	4231.9	8.2 Kb	4284.2	6.8 Du
	4234.0	7.8 Kb	4284.5	6.7 Kk
	4235.6	7.8 Kk	4288.6	6.8 Kk
	4242.8	7.6 Kk	4289.1	6.8 Du
	4246.0	7.8 Ch	4290.1	6.7 Du
	4247.9	7.6 Ch	4290.6	6.7 Kk
	4253.9	7.0 Ch	4291.1	6.8 Du
	4255.9	7.5 Kb	4292.6	6.8 Kk
	4256.6	7.0 Kk	4293.1	6.3 L
	4256.9	6.9 Ch	4294.1	6.8 Du
	4257.6	7.0 Kk	4298.2	6.6 Du
	4258.7	6.9 Kk	4298.3	7.1 Cy
	4259.6	6.8 Kk	4289.1	6.7 Du
	4261.9	7.1 Kb	4300.6	6.9 Kk
	4262.2	7.0 Du	4302.4	6.3 Pt
	4263.1	7.0 Du	4309.1	6.5 Du
	4264.2	7.1 Du	4310.1	6.4 Du
	4266.0	7.3 Kb	4313.1	6.5 Du
	4266.2	7.2 Du	4314.1	6.5 Du
	4267.6	6.6 Kk	4314.2	6.5 Jo
	4268.1	7.0 Du	4315.1	6.5 Du
	4271.6	6.6 Kk	4315.3	6.5 Sg
	4272.6	6.6 Kk	4316.1	6.4 Du
	4273.3	6.6 Pt	4317.3	6.4 Du
	4274.2	7.0 Du	4319.1	6.6 Jo
	4275.8	6.6 Kk	4319.2	6.3 Du
	4277.1	6.9 Du	4321.1	6.5 Ks
	4278.1	6.9 Du	4321.3	6.3 Du
210903 RR AQUARII—				
	4273.3	11.5 Pt	4302.4	12.8 Pt
211614 X PEGASI—				
	4264.4	12.9 Wf	4288.4	13.0 Wf
	4268.4	13.1 Wf	4296.4	12.9 Wf
	4273.4	13.2 Pt	4302.3	11.0 Wf
	4285.4	13.4 Wf		
211615 T CAPRICORNI—				
	4232.8	12.2 Bl	4258.8	[11.3 Bl
212030 S MICROSCOPII—				
	4232.8	11.4 Bl	4258.8	[12.4 Bl
212814 Y CAPRICORNI—				
	4232.8	[12.6 Bl		
213244 W CYGNI—				
	4250.8	6.1 Kd	4284.6	6.0 Kd
	4257.8	6.1 Kd	4290.6	6.1 Kd
	4260.7	6.1 Kd	4292.6	6.0 Kd
	4265.8	6.1 Kd	4295.6	6.0 Kd
	4271.6	6.0 Kd	4317.2	6.2 Cu
213678 S CEPHEI—				
	4269.2	8.5 Du	4314.1	8.4 Du
	4285.9	8.4 Lp	4316.2	8.4 Du
	4298.2	8.4 Du	4319.1	8.6 Du
	4298.3	8.2 Cy	4319.2	8.2 Cu
	4299.1	8.4 Du	4319.3	8.1 Cy
	4301.9	8.5 Lp	4321.1	8.8 Cu
	4302.4	7.3 Pt	4321.2	8.6 Ks
	4307.1	8.7 Cu	4322.1	8.8 Cu
	4312.0	8.7 Lp	4326.1	8.8 Cu
	4313.1	8.5 Du		
213753 RU CYGNI—				
	4273.4	8.5 Pt	4302.4	8.4 Pt
213843 SS CYGNI—				
	4246.9	11.7 Ch	4297.2	11.3 Wf
	4256.3	11.3 Wf	4297.2	11.5 Pt
	4256.9	11.4 Ch	4298.2	11.2 Cy
	4258.9	11.4 Ch	4298.3	11.4 Wf
	4259.9	11.3 Sh	4299.1	10.6 L
	4260.9	11.2 Kl	4299.1	11.2 Ie
	4261.9	10.7 Kl	4300.1	10.5 Cu
	4261.9	11.3 Ch	4300.2	10.0 Pt
	4262.3	11.0 Cy	4300.3	10.7 Bi
	4262.3	10.9 Wf	4301.2	9.8 Pt
	4262.9	10.4 Kl	4301.3	10.0 Bi
	4263.3	10.1 Cy	4302.3	9.7 Wf
	4264.2	9.6 Pt	4302.4	9.8 Pt
	4264.3	9.8 Wf	4303.4	9.5 Pt
	4266.8	8.8 Ch	4304.2	8.6 Cu
	4267.0	9.8 Kl	4304.3	8.7 Wf
	4267.3	9.4 Pt	4304.4	9.0 Pt
	4267.4	9.3 Br	4305.1	8.4 Cu
	4267.4	9.5 Br	4305.2	9.0 Pt
	4268.3	9.2 Pt	4306.2	9.2 Pt
	4268.4	8.9 Wf	4306.3	8.8 Wf
	4269.2	8.7 Cy	4307.1	8.8 Cu
	4269.2	8.7 Wf	4307.2	8.7 Cy
	4269.9	9.3 Kl	4307.3	9.0 Wf
	4270.2	8.8 Wf	4308.1	9.2 Cu
	4270.4	9.2 Pt	4308.2	8.8 Cy
	4270.9	9.2 Kl	4308.3	9.2 Wf
	4273.3	10.3 Pt	4309.1	9.5 Cu

VARIABLE STAR OBSERVATIONS RECEIVED DURING MAY AND JUNE, 1925—Continued

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
213843 SS CYGNI—Continued.				
	4275.3	11.5 Pt	4309.1	9.7 Ie
	4276.1	10.7 L	4309.2	9.7 Cy
	4278.3	11.4 Wf	4309.2	9.8 Pt
	4279.3	11.4 Wf	4311.2	10.5 Pt
	4280.3	11.3 Wf	4312.2	11.2 Pt
	4281.4	11.5 Wf	4313.1	10.9 Ie
	4282.3	11.7 Wf	4313.2	11.7 Pt
	4283.1	11.7 Pt	4313.2	10.4 Cy
	4283.9	11.3 Kl	4313.3	10.2 Sg
	4285.2	11.8 Pt	4314.1	10.2 Cu
	4285.4	11.6 Wf	4314.2	11.8 Pt
	4286.3	11.8 Pi	4315.1	10.7 Cu
	4287.3	11.3 Wf	4315.2	11.4 Ie
	4288.2	11.7 Pt	4315.2	11.8 Pt
	4288.4	11.3 Wf	4316.2	11.8 Pt
	4289.2	11.6 Cy	4317.1	10.7 Cu
	4289.2	11.6 Pt	4317.2	11.6 Pt
	4290.0	11.1 L	4318.	11.8 Ro
	4290.2	11.6 Pt	4318.1	11.7 Pt
	4291.4	11.5 Wf	4318.2	11.8 Bi
	4291.9	11.3 L	4318.2	11.5 B
	4292.1	10.7 L	4319.1	11.6 Cu
	4292.2	11.6 Cy	4319.2	11.0 Cy
	4295.2	11.6 Pt	4319.2	11.2 Du
	4295.3	11.6 Br	4320.2	11.8 Pt
	4295.4	11.5 Br	4321.1	11.3 Cu
	4296.4	11.6 Wf	4321.2	11.1 Ks
	4297.0	10.6 L	4322.1	11.4 Cu
213937 RV CYGNI—				
	4273.4	6.6 Pt	4303.4	6.6 Pt
214024 RR PEGASI—				
	4264.4	13.3 Wf	4291.4	13.8 Wf
	4269.4	13.5 Wf	4302.3	13.9 Wf
	4273.4	13.4 Pt	4303.4	13.6 Pt
	4285.4	13.6 Wf	4319.3	[13.2 Cu
214247 R GRUIS—				
	4232.7	[13.3 Bl	4258.8	[12.9 Bl
215605 V PEGASI—				
	4272.4	8.5 Pt	4303.4	10.4 Pt
	4301.3	10.0 Bi		
215717 U AQUARII—				
	4273.4	10.0 Pt	4303.4	11.6 Pt
215934 RT PEGASI—				
	4301.3	11.7 Bi	4303.4	10.8 Pt
220133b RZ PEGASI—				
	4273.4	9.1 Pt	4303.4	9.4 Pt
220613 Y PEGASI—				
	4301.4	[13.0 Bi		
220714 RS PEGASI—				
	4301.4	13.4 Bi		
222439 S LACERTAE—				
	4273.4	12.8 Pt	4303.4	12.5 Pt
	4301.4	12.8 Bi	4319.3	12.4 Cu
222867 R INDI—				
	4225.4	12.0 Bl	4252.4	9.7 Bl
	4232.7	10.9 Bl	4258.8	9.7 Bl
	4245.4	10.4 Bl		
223841 R LACERTAE—				
	4301.4	13.8 Bi		
230110 R PEGASI—				
	4253.9	7.8 Ch	4273.4	7.5 Pt
	4259.9	7.9 Ch	4275.8	8.3 Kk
	4271.8	8.5 Kk	4303.4	8.0 Pt
	4271.8	8.2 Kk		
230759 V CASSIOPEIAE—				
	4228.4	7.2 Kk	4263.4	8.8 Du
	4229.8	7.4 Kk	4268.4	9.2 Du
	4230.5	7.2 Kk	4273.4	9.1 Pt
	4231.8	7.2 Kk	4277.4	9.5 Du
	4235.8	7.3 Kk	4298.2	10.8 Du
	4242.8	7.9 Kk	4298.3	11.0 Cy
	4262.4	8.7 Du	4303.4	10.8 Pt
231425 W PEGASI—				
	4301.4	11.9 Bi		
231508 S PEGASI—				
	4273.4	10.6 Pt	4303.4	11.6 Pt
232848 Z ANDROMEDAE—				
	4273.4	9.6 Pt	4321.1	9.6 Cu
	4315.2	9.3 Cu	4322.1	9.6 Cu
	4319.2	9.5 Cu	4326.1	9.1 Cu
233335 ST ANDROMEDAE—				
	4273.4	10.8 Pt	4303.4	11.0 Pt
233956 Z CASSIOPEIAE—				
	4262.3	14.3 Wf	4291.4	14.2 Wf
	4269.4	14.2 Wf	4301.4	[13.6 Bi
	4285.4	14.2 Wf	4302.3	14.2 Wf
	4288.4	14.2 Wf	4319.3	[13.4 Cy
235053 RR CASSIOPEIAE—				
	4315.2	10.5 Cu	4321.3	10.7 Du
	4319.2	10.6 Du		
235350 R CASSIOPEIAE—				
	4227.8	7.3 Kk	4271.8	7.3 Kk
	4228.9	7.3 Kk	4275.8	7.1 Kk
	4229.8	7.3 Kk	4298.2	7.5 Du
	4230.8	7.1 Kk	4313.3	7.8 Du
	4231.8	7.1 Kk	4317.3	7.9 Du
	4235.8	7.2 Kk	4319.3	7.8 Du
	4242.8	6.6 Kk	4319.3	8.8 Cy
	4263.4	6.7 Du	4321.3	8.0 Du
	4268.4	6.9 Du		
235525 Z PEGASI—				
	4273.4	12.3 Pt	4303.4	12.8 Pt
235939 SV ANDROMEDAE—				
	4273.4	11.3 Pt	4303.4	12.5 Pt
	4301.4	12.4 Bi	4319.3	12.6 Cu

Total observations, 3350; stars observed, 360; total observers, 38.

The Mid-West members of the Association are contemplating a get-together, probably at the Yerkes Observatory early in September. Due notice will be sent to members in August.

The following observers have contributed to this double report: Allen, "Al"; Aurino, "Au"; Baldwin, "Bl"; Berman, "Bi"; Bouton, "B"; Brocchi, "Br"; Chandra, "Ch"; Chisolm, "Cm"; Cilley, "Cy"; Cunningham, "Cu"; Dunham, "Du"; Gaebler, "Gb"; Houghton, "Ht"; Iedema, "Ie"; Jones, "Jo"; Kanda, "Kd"; Kasai, "Kk"; Kleis, "Ks"; Koelbloed, "Kb"; Kohl, "Kl"; Lacchini, "L"; Mrs. Leavens, "Ls"; Leavenworth, "Lv"; Lepper, "Lp"; Mrs. Lytle, "Ly"; Marks, "Mx"; Marshall, "Mh"; Millman, "Mm"; Peltier, "Pt"; Petrie, "Pj"; Rhorer, "Ro"; Schuller, "Sh"; Skaggs, "Sg"; Smith, "Sm"; Waterfield, "Wf"; Braid-White, "Wb"; Yalden, "Ya"; and Miss Young, "Y".

LEON CAMPBELL, Recording Secretary.

July 7, 1925.

COMET NOTES.

Seven Periodic Comets Due this Summer.—The periodic comet Temple II was found by Stobbe at Bergedorf, Germany, on June 11 and by Delporte at Uccle, Belgium, on June 12. It is faint but increasing in brightness and will not reach perihelion until about August 7.

Wolf's periodic comet was also found by Stobbe on July 13, close to the place predicted in a circular from the Observatory at Cracow. It was then of about magnitude 15 so that it could be seen only with large telescopes.

Five other periodic comets are due this year and some of them may be observed this summer. The search ephemerides given below, excepting those for Schorr's and Brooks' comets, are taken from the B. A. A. Handbook for 1925.

EPHEMERIS OF COMET TEMPLE (2).

[Computed by G. Merton from new elements by A. C. D. Crommelin. B. A. A. Circular No. 7.]

		α 1925.0	δ 1925.0	log r	log Δ
	1925	h m s	° ′		
Aug.	1	18 59 29	—24 05		
	5	19 06 34	—26 48	0.119	9.517
	9	19 14 37	—29 20		
	13	19 23 33	—31 39	0.119	9.539
	17	19 33 19	—33 41		
	21	19 43 49	—35 26	0.122	9.570
	25	19 54 56	—36 53		
	29	20 06 32	—38 01	0.126	9.608

EPHEMERIS OF WOLF'S PERIODIC COMET.

[From the Cracow Observatory circular; given in Copenhagen Circular No. 73.]

	12h G. C. T.	True α	True δ	Δ
	1925	h m	° ′	
Aug.	1	23 01.8	+25 22	1.804
	9	23 01.0	+25 20	1.727
	17	22 59.1	+24 55	1.659
	25	22 56.2	+24 07	1.602
Sept.	2	22 52.6	+22 53	1.558
	10	22 48.9	+21 16	1.528

SEARCH EPHEMERIDES FOR SCHORR'S PERIODIC COMET.

[From the Copenhagen Circular 72. Computer J. Larink.]

Date 0h G. C. T. 1925	T = May 23.9 α 1925.0	T = May 23.9 δ 1925.0	T = May 27.9 α 1925.0	T = May 27.9 δ 1925.0	T = May 31.9,1925 α 1925.0	T = May 31.9,1925 δ 1925
	h m	° ′	h m	° ′	h m	° ′
Aug. 2	5 57.6	+20 22	5 52.7	+20 15	5 47.8	+20 08
4	6 02.5	+20 24	5 57.6	+20 17	5 52.6	+20 10
6	6 07.3	+20 25	6 02.4	+20 19	5 57.5	+20 12
8	6 12.1	+20 25	6 07.2	+20 20	6 02.3	+20 14
10	6 16.8	+20 25	6 12.0	+20 20	6 07.1	+20 15
12	6 21.5	+20 25	6 16.7	+20 20	6 11.9	+20 15
14	6 26.1	+20 24	6 21.4	+20 20	6 16.6	+20 15
16	6 30.8	+20 22	6 26.1	+20 19	6 21.3	+20 14
18	6 35.4	+20 20	6 30.7	+20 17	6 25.9	+20 13
20	6 39.9	+20 18	6 35.2	+20 15	6 30.5	+20 12
22	6 44.4	+20 15	6 39.8	+20 13	6 35.0	+20 10
24	6 48.9	+20 13	6 44.3	+20 10	6 39.5	+20 08
26	6 53.3	+20 08	6 48.7	+20 06	6 44.0	+20 04
28	6 57.7	+20 04	6 53.1	+20 03	6 48.4	+20 01
30	7 02.0	+20 00	6 57.4	+19 59	6 52.7	+19 57
Sept. 1	7 06.3	+19 55	7 01.7	+19 55	6 57.0	+19 53
3	7 10.5	+19 50	7 05.9	+19 50	7 01.3	+19 49

SEARCH EPHEMERIDES FOR FAYE'S PERIODIC COMET.

[From the B. A. A. Handbook for 1925.]

Date 0h G. C. T. 1925	Perihelion Sept. 12.0 α 1925.0	Perihelion Sept. 12.0 δ 1925.0	Perihelion Sept. 20.0 α 1925.0	Perihelion Sept. 20.0 δ 1925.0
	h m	° ′	h m	° ′
Aug. 3	3 40.9	+20 20	3 23.7	+20 14
11	4 03.4	+20 38	3 45.5	+20 39
19	4 25.7	+20 40	4 07.4	+20 48
27	4 47.7	+20 26	4 28.9	+20 42
Sept. 4	5 09.1	+19 56	4 50.0	+20 18
12	5 29.6	+19 11	5 10.3	+19 39
20	5 49.0	+18 11	5 29.4	+18 44
28	6 07.0	+16 58	5 47.2	+17 34

SEARCH EPHEMERIDES FOR BORRELLY'S PERIODIC COMET.

[From the B. A. A. Handbook for 1925.]

Date 0h G. C. T. 1925	Perihelion Oct. 9.0 α 1925.0	Perihelion Oct. 9.0 δ 1925.0	Perihelion Oct. 17.0 α 1925.0	Perihelion Oct. 17.0 δ 1925.0
	h m	° ′	h m	° ′
Aug. 6	4 40.2	— 0 17	4 27.1	— 3 29
14	5 02.1	+ 1 36	4 48.3	— 1 46
22	5 24.6	+ 3 31	5 09.8	0 00
30	5 47.1	+ 5 30	5 31.6	+ 1 51
Sept. 7	6 10.1	+ 7 32	5 53.6	+ 3 48
15	6 33.5	+ 9 39	6 16.0	+ 5 52
23	6 57.2	+11 51	6 38.6	+ 8 04
Oct. 1	7 21.4	+14 09	7 01.5	+10 27

SEARCH EPHEMERIS FOR BROOK'S PERIODIC COMET (1889 V).

[Computed by F. E. Seagrave. From A. J. No. 850.]

Perihelion Nov. 8, 1925.

0h G. C. T. 1925	α 1925.0	δ 1925.0	log r	log Δ
	h m s	° ′		
Aug. 4	23 06 55	—0 39	0.3126	0.0604
12	23 07 27	—0 55	0.3070	0.0339
20	23 06 26	—1 28	0.3016	0.0108

Nearest to earth Sept. 18, 1925.

SEARCH EPHEMERIDES FOR THE TEMPLE-SWIFT PERIODIC COMET.
[From the B. A. A. Handbook for 1925.]

Date 0h G. C. T. 1925		Perihelion Oct. 17.0 α 1925.0	δ 1925.0	Perihelion Oct. 25.0 α 1925.0	δ 1925.0
		h m	° ′	h m	° ′
Aug.	6	1 11.5	+16 39	0 31.8	+12 35
	14	1 36.7	+20 25	0 49.3	+16 08
	22	2 05.6	+24 23	1 09.7	+20 03
	30	2 39.0	+28 22	1 33.3	+24 22
Sept.	7	3 17.5	+32 06	2 01.4	+28 59
	15	4 01.0	+35 12	2 35.1	+33 41
	23	4 48.3	+37 18	3 15.7	+38 03
Oct.	1	5 36.4	+38 07	4 03.0	+41 29

Comet *b* 1925 (Reid).—The following sketch of the motion of Comet *b* 1925, computed by Mr. J. Johannsen from new elements by G. Merton, shows that the comet will come north during the coming winter, but will be hidden by the sun most of that time.

Date 1925-26		0h G. C. T. α 1925.0 h m	δ 1925.0 ° ′
Aug.	1	13 31.3	—49 13
Sept.	2	15 45.3	—53 44
Oct.	4	18 14.9	—49 24
Nov.	5	20 03.5	—39 32
Dec.	7	21 20.7	—28 56
Jan.	8	22 16.9	—20 19
Feb.	9	23 04.5	—12 42

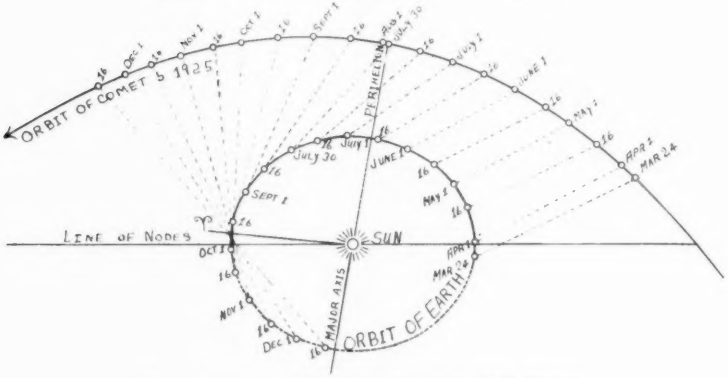


DIAGRAM OF THE ORBIT OF COMET *b* 1925 (REID).

Comet *c* 1925 (Orkisz).—New elements of this comet have been computed by Messrs. J. Witkowski and K. Kordylewski from 80 observations during the interval April 5 to May 27. The comet is much fainter than it was in June but may be seen with good telescopes, toward the northwest in the evening.

ELEMENTS OF COMET *c* 1925.

T = 1925 April 1.4782 G. C. T.
ω = 36° 09′.2
Ω = 318 03.2 } 1925.0
i = 100 00.8
q = 1.10930

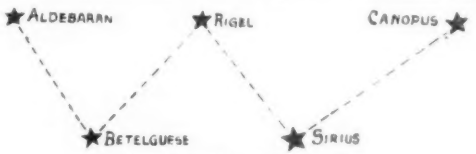
EPHEMERIS FOR 0^h G. C. T.
[From the Copenhagen Circular No. 70.]

Date 1925	True α h m s	True δ ° ′	r	Δ
Aug. 3	10 50 03	+49 05.5	2.1661	2.8491
7	10 54 24	+47 48.9	2.2123	2.9167
11	10 58 34	+46 37.2	2.2585	2.9817
15	11 02 34	+45 30.2	2.3046	3.0437
19	11 06 26	+44 27.4	2.3508	3.1026
23	11 10 10	+43 28.7	2.3969	3.1583
27	11 13 46	+42 33.9	2.4429	3.2107
31	11 17 15	+41 42.7	2.4889	3.2597
Sept. 4	11 20 37	+40 55.0	2.5348	3.3052
8	11 23 53	+40 10.6	2.5806	3.3471

Comet Catalogue.—*Memoirs of the British Astronomical Association*, Vol XXVI, Part 2, consists of a catalogue of the orbits of comets observed from the beginning of 1894 to April, 1925, together with improved orbits of many earlier comets. This is a sequel to *Galle's Cometenbahnen* and brings the data of comet orbits up to date. This catalogue has been prepared by A. C. D. Crommelin.

COMMUNICATIONS.

A Great W in the Sky.—About the middle of December these five first magnitude stars rise in the east in the early part of the night and form a great W. The W in Cassiopeia is but a miniature compared with it. Were Canopus a little more northerly the W would be perfect. Here (about 25° south latitude) these five great rulers of our sky form a magnificent spectacle, especially in our



A GREAT W IN THE SKY.

midsummer. It should be called *"W Magnus Australis."* I sent a notice of this sidereal W to the "Maryborough Chronicle" in May, 1924, and to the Brisbane "Daily Mail" in November of the same year.

T. M. DONOVAN.

Dundowvan, Maryborough, Queensland, May 18, 1925.

An Explanation. — In the June-July issue of POPULAR ASTRONOMY, which we have just received, I notice a letter from Dr. Shapley regarding our confusion of Tuttle's and Shajn's comets, and as I wrote the article in question, I would like to explain the circumstances, for, as you know, our aim is to combine popular science with strict accuracy.

Firstly, the article did not attribute the identification of the new comet with Tuttle's to Dr. Shapley, but, as you will see by the enclosed copy of the article, stated that "it is said to be Tuttle's comet," etc. The confusion arose because we could not identify Schain at the time, and assumed that it meant "Mechain" and was altered in transmission. As you know, Mechain, at Paris, discovered

the comet in 1790 which was lost and rediscovered by Tuttle in 1858 at Harvard. As this object, according to the table in the Encyclopedia Britannica, is due within the next year or so, you will see that the error was a natural one. However the error was soon discovered and in our bulletin for April 9th we published the correct account.

JAMES STOKLEY.

Science Service, Washington, D. C., June 9, 1925.

GENERAL NOTES

Rev. A. L. Cortie, S. J., director of the Stonyhurst Observatory, died on May 16, 1925, at the age of 66 years. He was for 44 years on the staff of the Stonyhurst Observatory, and succeeded Father Sidgreaves as director in 1919. His chief astronomical work was in the study of the connection between the sunspots and terrestrial magnetism. He took part in several eclipse expeditions and was a familiar figure in various international astronomical gatherings.

Prof. A. S. Eddington, Plumian Professor of Astronomy at Cambridge University, has been elected a Foreign Associate of the National Academy of Science, Washington, D. C.

Comet Medal Awarded to Prof. Wolf.—The Comet Medal of the Astronomical Society of the Pacific has been awarded to Professor Max Wolf of Heidelberg, Germany, for the discovery of an unexpected comet on December 22, 1924. This comet was very faint and has been seen by only a few observers.

Interferometer Measures of the Spectroscopic Binary Star Mizar.—In *Pub. Ast. Soc. Pacific* for June, 1925, Mr. F. G. Pease, of the Mount Wilson Observatory, gives results of measures with the 20-foot interferometer of the spectroscopic binary star Mizar, on the nights of April 16, 17, 19 and 20, 1925. The ordinary seeing was poor, the interferometer seeing fair. Beta, epsilon, and eta Ursae Majoris were used as check stars. The results are given in the accompanying table.

G. C. T. 1925	Position Angle—Measured	Position Angle—Calculated	Separation of Mirrors	Separation of Stars—Measured	Separation of Stars—Calculated
	°	°	feet	″	″
Apr. 16.3	247	251	16	0.013	0.014
17.3	260	259	16	0.013	0.014
19.3	280	279	18	0.011	0.012
20.3	292	298	18	0.011	0.009

The calculated angle and separation were obtained by using Hadley's spectroscopic elements, $P = 20.526$ days, $\omega = 104°$, $e = 0.53$, $(a_1 + a_2)$ sin $i = 32{,}880{,}000$ km, with periastron passage April 22.2 G. C. T., computed by Russell. The quantities $\Omega = 285°$ and $\gamma = 50°$ were derived from a plot of the observations, and the parallax 0″.045 from the group motion of the Ursa Major stars.

VZ Scuti.—In the Harvard Bulletin 821 the position of this variable star is corrected to read: R. A. 1900 $18^h\,31^m\,21^s$, Dec. 1900 $-12°\,49'.3$. The range of magnitude given in Harvard Circular 265 is from 12.2 to 13.0 magnitude.

Professor Beljawski of Simeis, Russia, finds from his plates that this star was close to minimum on June 24.40, 1914, and July 9.42, 1915, so that it is a short period, eclipsing variable.

Nova Pictoris.—A communication from Dr. J. S. Paraskévopoulos at Arequipa, dated May 28, states that the spectrum of Nova Pictoris was of Class F on May 27 and 28. Spectrograms and direct photographs are being made with several telescopes.

The visual magnitude on May 27 was 2.3, and on May 28 was 2.2, according to estimates by Dr. and Mrs. Paraskévopoulos.

A radiogram received from Professor Hartmann, director of the University Observatory at La Plata, Argentina, states that on June 10 the spectrum of Nova Pictoris was of the characteristic nova type.

The approximate position announced for the nova agrees with the position of the tenth magnitude star C. P. D. -62° 679. Miss Woods has examined the image of this star on 103 Harvard plates extending from 1890 to 1924, but has found no evidence of variability. On twenty-nine plates made with the Bache telescope between 1890 and 1918 she has examined all stars brighter than magnitude 13 within one degree of the position of the nova, but no change was noted.

A later communication from Dr. Paraskévopoulos, dated June 12, contains the following information concerning Nova Pictoris.

As shown by spectrum plates taken with the 13-inch Boyden telescope and by visual estimates of magnitude, this nova is proving to be one of the most peculiar that have ever appeared. The star is making the regular progress usual to novae, but very slowly. From May 27 to June 11 no bands (bright or dark) have appeared. The H and K lines are strong and with no appreciable changes. The most conspicuous changes have occurred in the region of Hβ, and that line itself has passed alternately from emission to absorption and back again to emission.

On June 10 the lines Hβ, Hγ, and Hδ appeared bright (emission) and wide. Also a number of other emission lines showed for the first time.

The visual magnitude increased slowly after May 27 from 2.3 on that date to 1.1 on June 9. On June 10, when the most conspicuous change, up to date, occurred in the spectrum, the visual magnitude began to decline.

The following table gives the visual magnitudes.

Date		Magnitude	Date	Magnitude
May	29	2.3	June 5	1.6
	30	2.3	6	1.4
	31	2.2	7	1.35
June	1	2.2	8	1.3
	2	2.1	9	1.15
	3	2.1	10	1.3
	4	1.9	11	1.7:

Clouds disturbed the observations on the last two dates.

The following observations have been received from W. H. Smith, Cape Town, South Africa, with visual magnitudes based on the Backhouse catalogue:

Date (G.C.T.)		Magnitude
May	28.7	2.5
	29.7	2.5

Harvard College Observatory Bulletin 821.
Cambridge, Massachusetts, July 1, 1925.

Water Vapor and Oxygen on Mars.—In *Pub. Ast. Soc. Pac.* for June, 1925, is an abstract of a paper by W. S. Adams and C. E. St. John, in which occur the following statements:

....."the strength of the atmospheric lines due to Mars relative to the terrestrial lines was 0.09 for water vapor and 0.37 for oxygen.

"Considerations of length of path, the elevation of the observing station, and the quantity of water vapor and oxygen above Mount Wilson indicate that for equal areas the water vapor above the surface of Mars at the time of the observation was of the order of 5 and the oxygen of the order of 15 percent of that normally in the earth's atmosphere, that is, the oxygen was less than above Mt. Everest."

These statements are based on the measurements of spectrograms of Mars and of the sky taken on February 2, 1925, with the 6-prism spectrograph and the 60-inch reflector.

American Astronomical Society.—The thirty-fourth meeting of the American Astronomical Society will be held at Goodsell Observatory of Carleton College, Northfield, Minnesota, from September 8 to 11, 1925.

The following information is given in the Circular of Information sent out by Secretary Joel Stebbins in June:

"Northfield is about thirty-five miles south of St. Paul, Minnesota, and may be reached by way of the Chicago, Milwaukee and St. Paul, and the Chicago, Rock Island and Pacific railroads. The Rock Island trains passing directly through Northfield leave Chicago at 3:30 P. M. and 12:50 A. M., reaching Northfield at 6:20 A. M. and 5:00 P. M., respectively.

"The C. M. and St. P. train leaves Chicago at 6:10 P. M., arriving at Northfield at 8:32 A. M. In some cases it may be more convenient to take one of the many through trains from Chicago to St. Paul, and then use the local trains from St. Paul to Northfield.

"Members are reminded that advantage can be taken of reduced summer fares. In particular, such an excursion as to the Yellowstone National Park can be combined to advantage with the trip to the meeting.

"Northfield is on Route No. 1 of the State Highway system, which is identical with the Jefferson Highway in the southern part of the state. The latter connects with the main highways from the other states. Of the various motor routes from Chicago, the undersigned would recommend that via Williams Bay, Madison, Baraboo, La Crosse, Winona, Rochester, Cannon Falls, Northfield. Up-to-date information on Wisconsin roads may be secured in Madison by telephoning Badger 7305, the Association of Commerce, except on Sundays and holidays.

"Those coming in automobiles will find the college on First Street on the east side of the river, three blocks east and three blocks north of the central square of the city. The college is within walking distance from the railroad station, but taxis will be available for those having heavy luggage.

"Members of the Society and visitors will be given rooms and board in one of the college dormitories, in which there are suitable accommodations for both men and women. It is expected that the cost will not exceed $3.50 per day for room and meals.

"The gymnasium and swimming pool will be available to the men, and the golf course and tennis courts to both men and women attending the meeting. In case the weather should be warm enough the college lake will be available for swimming, so it will be well for those who wish to bring bathing suits. The

probability is that the weather will be warm in the early part of September, but the evenings may be chilly.

"Because of the absence of the Secretary from the country until early in September, all correspondence in regard to the meeting, reservations of rooms, and titles of papers, should be addressed to Professor H. C. Wilson, Goodsell Observatory, Northfield, Minnesota.

PROGRAM (Subject to change).

Tuesday, September 8, 1925—

8:00 P. M. Opening Reception.

Wednesday, September 9—

8:30 A. M. Meeting of the Council, Goodsell Observatory.
10:00 A. M. Session for papers, Laird Hall.
2:30 P. M. Session for papers.
8:00 P. M. Eclipse motion pictures.

Thursday, September 10—

9:00 A. M. Meeting of the Council.
10:00 A. M. Session for papers.
2:30 P. M. Session for papers.
6:30 P. M. Special dinner.

Friday, September 11—

9:00 A. M. Meeting of the Council.
10:00 A. M. Session for papers.
2:30 P. M. Session for papers.

Comparison of Messier 33 and the Large Magellanic Cloud.—Some further suggestive comparisons can be made between the spiral Messier 33 and the Large Magellanic Cloud, in addition to that given in the preceding note* for their two largest gaseous nebulae.

1. The greatest linear diameter of the spiral is about 4.5 kiloparsecs. The average diameter of the Cloud is 4.3 kiloparsecs.

2. The integrated absolute magnitude (visual) of Messier 33 is approximately —15 (Holetschek's apparent magnitude is 7?). The corresponding value for the Large Cloud has not yet been determined, but it is known to be not fainter than —15 and probably is not brighter than —17.

3. The average diameter of the hundreds of secondary nuclei in Messier 33 is of the order of five parsecs. The average diameter of the brighter star clusters in the Large Cloud is fifteen parsecs. The average diameter of the gaseous nebulae in the Large Cloud, excluding 30 Doradus, is about seven parsecs, with a wide dispersion (H. C. 271); and in the Small Magellanic Cloud, the average for 120 irregular nebulae, many of them involving stars, is five parsecs (H. C. 275, in press).

4. The integrated absolute magnitudes of the nuclei in Messier 33 are largely between —4 and —5, with several groups of nuclei as bright as —7.5. The integrated absolute magnitudes of the twenty brightest clusters in the Magellanic Clouds average about —8.5, but there are many open clusters two or three magnitudes fainter. The average value for the diffuse nebulae that show bright-line spectra (again excluding 30 Doradus) is —7.6.

These comparisons, though admittedly provisional, are sufficient to justify classing the Magellanic Clouds with the spirals. They also serve to suggest the nature of the nebulous condensations in the spirals.

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*See POPULAR ASTRONOMY for May, 1925, p. 338.

It is difficult to find any trace of genuine spiral structure in the Magellanic Clouds. Lundmark has suggested that tentatively we should class the Clouds in the special group of non-galactic nebulae that is represented by such irregularly formed objects as N. G. C. 3034 and N. G. C. 4449. In the same group would be placed the remote star cloud, N. G. C. 6822, discussed in Harvard Bulletin 796.

The analogies in detail pointed out above for a typical spiral nebula and for the Large Cloud indicate that there is a valuable approach to the difficult problem of external stellar systems by way of the analysis of individual stars, clusters, and nebulae in the Magellanic Clouds.

Harvard College Observatory Bulletin 816.

Fused Quartz for Astronomical Mirrors.—The many advantages offered by the use of clear fused quartz for astronomical mirrors were outlined by Professor Elihu Thomson, director of the Thomson Research Laboratory of the General Electric Company at Lynn, Mass., before a meeting of the Franklin Institute of Philadelphia. At the meeting he received the Franklin Medal for his achievements in the electrical field.

"For twenty-five years," said Professor Thomson, "I have borne in mind the great desirability of procuring fused silica disks instead of glass for astronomical mirrors. It is its low coefficient of expansion and its consequences which confer such great superiority as the silica disk possesses. This may be stated under several heads.

"1. Disks require but little annealing, while with the large glass this is a matter of great difficulty.

"2. They can be rough ground by a carborundum wheel without danger of fracture, an operation difficult with glass and rarely resorted to.

"3. The disks can be made very thick and rigid more easily than with glass.

"4. The fine grinding (or smoothing before polishing) is carried on with great facility, and the surface before polishing is usually of finer grain than with glass. The fused silica is considerably harder than glass, and not so easily scratched.

"5. The polishing proceeds readily and can be carried on regardless of temperature changes. Incidentally, there is less liability of scratches forming in polishing.

"6. In very accurate work, figured by polishing, as in high grade surfaces of astronomical mirrors, the polishing and testing need not be interrupted as with glass by long rest periods, with the mirror disk kept jacketed in felt for equalization of temperature. This is very important and involves great saving of time.

"7. In service, none of the precautions against temperature variations and distortions arising therefrom are needed, and even in solar work with full sunshine on the mirrors, no evil result follows.

"When it is remembered that it took two years of testing and polishing for figure, involving long interruptions for equalization of temperature, to produce the 100-inch glass mirror mounted at Mt. Wilson, near Pasadena, California, the advantage offered by fused silica is evident.

"The optician will welcome the possibility of obtaining so-called flats of desired sizes, not subject to temperature distortion, while the making of accurate flat surfaces is evidently greatly facilitated. The silvering of surfaces of fused silica appears to be no more difficult than with glass, with the advantage, however, that the former can be warmed without risk when such warming is needed to assist the formation of the silver deposit."

United States Civil Service Examination for Nautical Assistant.—The United States Civil Service Commission announces the following open competitive examination for Nautical Assistant.

Receipt of applications for nautical assistant will close August 29. The date for assembling competitors will be stated on the admission cards sent applicants after the close of receipt of applications.

The examination is to fill vacancies in the Hydrographic Office of the Navy Department, for duty in Washington, D. C., or elsewhere.

The entrance salary for this position in the District of Columbia is $1,680 a year. Advancement in pay may be made without change in assignment up to $2,040 a year. For appointment outside of Washington, D. C., the salary will range from $1,320 to $2,040 a year. There is a vacancy at New York City at an entrance salary of $1,320 a year. Promotion to higher grades may be made in accordance with the civil service rules.

The duties of these positions consist principally of the following: To prepare for publication books of sailing directions, light lists, and lists of radio signals; to examine technical reports and prepare technical matter for publication in Notice to Mariners, Hydrographic Bulletin, Pilot Charts, Notice to Aviators, and Reprints of Hydrographic Information; and to make mathematical computations, including chart projections, magnetic data (variation, dip, horizontal intensity), navigational tables, radio distances and bearings, triangulations, tidal elements, etc.

Competitors will be rated on pure mathematics; navigation, theory and practice; physical geography; nautical definitions; seamanship; and education and experience.

Full information and application blanks may be obtained from the United States Civil Service Commission, Washington, D. C., or the secretary of the board of U. S. civil-service examiners at the post office or customhouse in any city.

Eclipses of the Sun, S. A. Mitchell, Second edition, Revised and enlarged, Columbia University Press, 1924.

The first edition of this excellent book proved so popular that a second edition became necessary only a year later. In the new edition a few errors found in the first have been corrected and a chapter added on the eclipse of September 10, 1923. This book should be read not only by everyone interested in astronomy but also by everyone who desires a well-written and interesting exposition of one of the grandest of natural phenomena, a total eclipse of the sun.

General Astronomy, H. Spencer Jones, Longmans Green & Co., New York, 1925, 392 pp.

This new book on astronomy will be welcomed by the general reader who has a slight knowledge of the elements of the subject. The more recent developments in astronomy, such as spectroscopic parallaxes, the determination of the diameters of some of the giant stars, Shapley's work on globular clusters and the theoretical work of Eddington and Jeans are explained in very simple terms. Mathematical developments and formulae, the bugbears of the general reading public, are almost wholly omitted. There are 24 full-page illustrations as well as over 100 diagrams in the text. The book is designed not so much for a text-book as for an up-to-date general exposition covering the field of astronomy. It can be heartily recommended to anyone who desires a book of this kind.

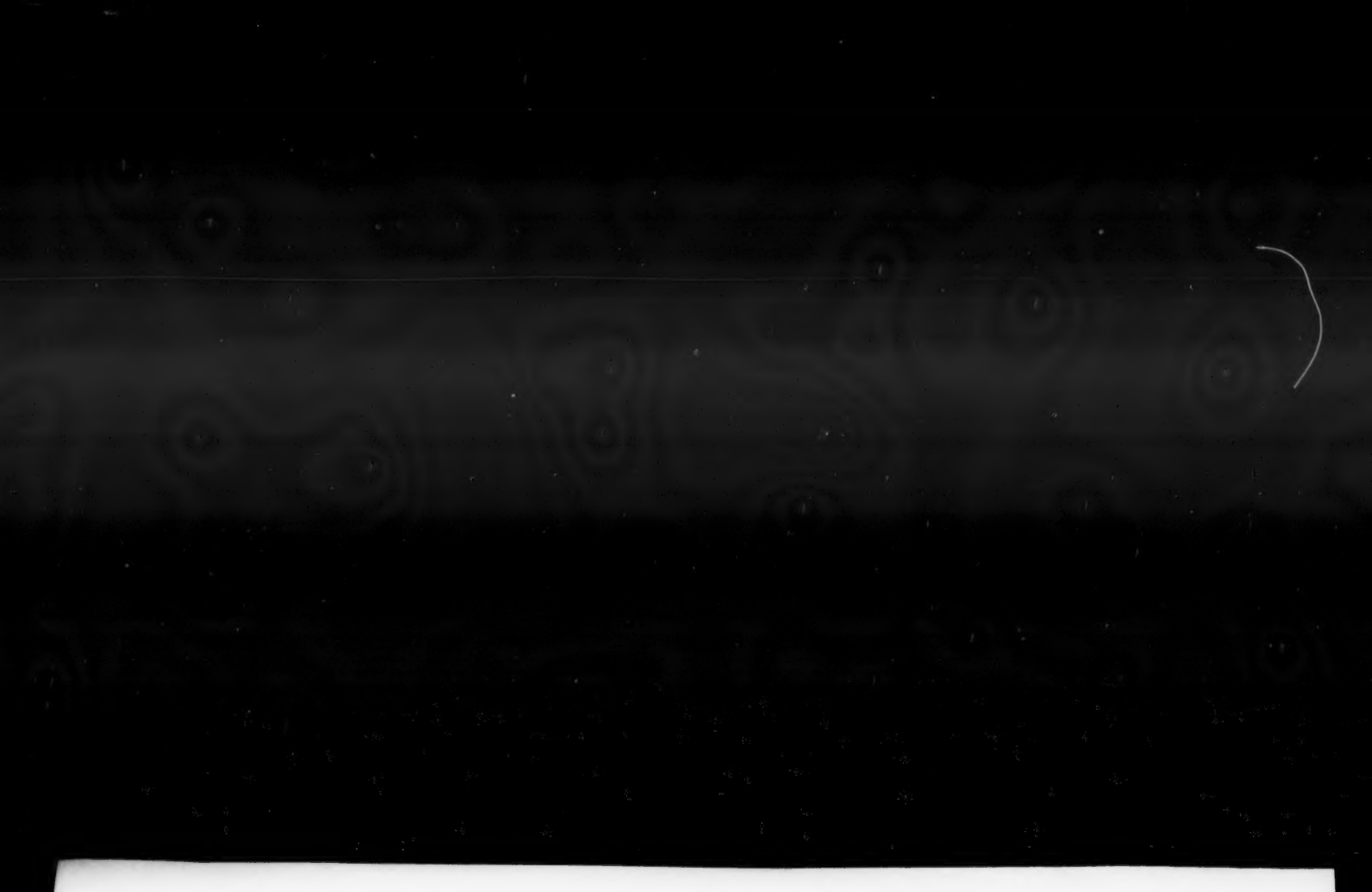
The Heavens by J. H. Fabre, translated by Dr. E. E. Fournier d'Abbe, 336 pp. J. B. Lippincott Company, no date.

This book was written by a man who had a very clear conception of the geometrical relationships involved in astronomy and who had the ability to present these with remarkable clarity. The physical side of the subject, however, is on the average at least 50 years behind the times. Thus, on page 198, "Perhaps they (sun-spots) are holes opening in an envelope of flames, and allowing us to see the dark interior"; page 257, "The axis of the planet (Mercury) is so much inclined to the plane of the orbit that the Sun is in turn very near one pole or the other...."; page 258, "Astronomers agree in recognizing on Venus mountains of such a height that we can scarcely believe it. It is said that some of them are 27 miles high"; page 279, "Eight moons circulate round the planet (Uranus)"; page 308, "Light takes 3.5 years to reach us from one of the nearest stars, Alpha in the Centaur" and page 310, footnote, "A smaller star, called Proxima Centauri, has recently been discovered at about half that distance"; page 328, "We need only remember that the Sun with its planets is making for that region of the sky (Hercules) at the rate of five miles a second"; etc. The publisher's state, "Wherever recent atronomical progress has added fresh material essential to the author's plan, such material has been added by the translator in the form of footnotes." The quotations from the text do not seem to show this "added fresh material." It is unfortunate that such a reputable publishing house has been misled by its technical advisers to put such a volume on the market, a volume which was correct in the accepted facts about the time of our Civil War and which says nothing about the great work of the present century with the exception of footnotes on star diameters and the more recent satellite discoveries.

Weltentstehung in Sage und Wissenschaft, Ziegler u. Oppenheim, price 1.80 marks (Teubner, Leipzig, 1925). This little volume of 127 pages is divided into two parts, the first giving the cosmological theories of the ancients and the second the modern theories of the life history and structure of the stars and of the solar system. The theories of Kant and Laplace are given about sixteen pages, while the planetesimal theory of Chamberlain and Moulton is given less than two pages. Lockyer's meteoric theory and those of Darwin and See on double stars are also mentioned. The reviewer missed references to the work of Jeans and of Jeffrey and noted an error in the statement of the planetesimal hypothesis, in that it is a sun and not "a chaotic nebulous mass" which was assumed the antecedent of the solar system. The authors have succeeded in bringing a wealth of material into a small and very readable volume.

THE CROSS OVERHEAD.

Dog days are past, autumnal days draw nigh,
Again the Cross of Cygnus glitters high
Where, westward, Vega sparkles blue and fair,
And, eastward, beams the beacon of Altair;
A gleaming Cross, spectacular and bright,
Looms like an omen midst the dome of night,
In ebon frame, it glitters overhead
With five rare jewels crowned by Arided,
When dog days end and autumn days are nigh,
And Charles's Wain adorns the northern sky.

CHARLES NEVERS HOLMES.

18 Pearl St., Reading, Mass.